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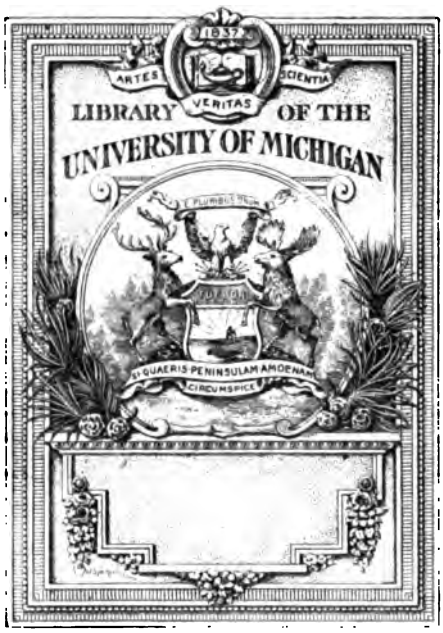
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CONTENTS OF VOLUME VI.

SPECIAL ARTICLES.

PAGE

Abbott, C. C. Aestivation of mammals; what is it? . 402
Action of cold on microphytes 393
Activity of the mind during sleep 344
Advance in fish-culture 353
African smithy. *Ill.* 347
Agricultural convention at Washington 68
Agassiz, A. The coast survey and 'political scientists,' 253
Agassiz, Life of. *Portrait* 330
Agassiz museum at Cambridge. *Ill.* 421
Alert expedition 350
American association at Ann Arbor 201
American association. — Proceedings of the section of anthropology. 230
American association. — Proceedings of the section of astronomy and mathematics 204
American association. — Proceedings of the section of biology 224
American association. — Proceedings of the section of chemistry 210
American association. — Proceedings of the section of economic science and statistics 235
American association. — Proceedings of the section of geology and geography 219
American association. — Proceedings of the section of histology and microscopy 227
American association. — Proceedings of the section of mechanical science 214
American association. — Proceedings of the section of physics 206
American engineers at Deer Park 13
Angell, J. B. A need for a careful study of the history of China 479
Answer to charges affecting the geological survey . . . 424
Artificial winds 462
Association of official agricultural chemists 248
Astronomical progress in 1884 71
Atkinson, E. The application of science to the production and consumption of food 234
Bacilli of cholera asiatica and cholera nostras 252
Ben Nevis astronomical observatory. *Ill.* 459
Bertillon, J. Height in France. *Ill.* 523
Blackfoot tribes 456
Bland, Thomas 440
Bolton H. C. Chemical nomenclature 368
Bone-caves in Wales 53
Brooks, W. K. Artificial propagation and cultivation of oysters in floats 437
Bunker, F. S. Anti-cholera inoculation 439
Carbolic acid as a disinfectant 566
Cailletet, L. The liquefaction of oxygen. *Ill.* . . . 51
Chandler, S. C., jun. The change in the great nebula in Andromeda 247
Channing, E. Bulgaria and Bulgarians. *Map* . . . 303
The Burman dispute. *Maps* 399
Cheyne's observations on the cholera microbe 193
Chloroform as an anaesthetic 154
Cholera prospects for England 437
Civilization and eyesight 195
Committee reports of the American association 202
Comparison of the skulls of assassins and men of note. *Ill.* 72
Composite portrait of the officers of the American association. *Portrait* 167
Composition of the wheat grain 415
Conn, H. W. A suggestion from modern embryology, 481
Consumptive period 34
Corthell, E. L. The ship-railway between the Atlantic and Pacific. *Ill.* 33
D., W. M. The recent tornadoes 252
Dall, W. H. The native tribes of Alaska 228
Deaths from wild beasts and snakes in India 344
Development of the eye. *Ill.* 194
Dewey, J. Education and the health of women . . . 341
Drought and weathercocks 528
Dutton, C. E. The latest volcanic eruption in the United States 46
E., S. Hypnotism 504
Edible clam introduced on the Atlantic coast 53
Edison, Thomas Alva. *Portrait* 145
Effect of the settlement of North America upon its wild animals 416
Elective studies at Harvard 499
Ensilage in England 500
Entomology in the national museum 445
Excavation of the temple of Luxor. *Ill.* 370

PAGE

Extraction of sugar from sorghum and sugar-cane . . . 524
Fletcher, Alice C. An average day in camp among the Sioux 285
An evening in camp among the Omahas 88
Flood Rock explosion felt at Harvard college 353
Forms of ships for war and for peace 569
Franklin, Christine L. Science in common schools, 289
French academy in its origin 105
Gage, S. H. The limitations and value of histological investigation 226
Gagem, C. von. The ascent of Popocatapetl 390
Galton, F. Types and their inheritance 268
Gardiner, F., jun. An Arizona natural bridge. *Ill.* . 67
Geology of Japan 13
German universities from a new point of view. *Map* . . 244
Government and its scientific bureaus 530
Gray, Asa; his seventy-fifth birthday. *Ill.* 465
Growth of the French academy, 1635–1885 190
Hague, A. The decay of the obelisk 510
Hallett, H. S. Exploration in Indo-China. *Ill.* . . . 106
Harrington, M. W. Lost rivers 265
Higginson, T. W. American flash language again . . 283
Historical association at Saratoga 249
Hitchcock, C. H. The latest slides in the White mountains 306
The recent land-slide in the White Mountains. *Ill.* . . 84
Honor to American opticians 306
Howe, H. M. The Clapp-Griffiths Bessemer plant . . 342
Hubbard, G. G. The Kongo Free State 163
Huxley on Darwin. *Portrait* 10
Incandescent lamps on railways 153
Industries of Siberia 348
Ingersoll, E. Canadian plains 565
The plains of British America 468
International geological congress at Berlin 376
J., J. Illustrations of recent Italian psychology . . . 413
Productiveness 479
Racial characteristics of Jews. *Ill.* 322
Some reaction-time studies 458
Jacques, W. W. Underground wires 6
James, E. J. Recent land legislation in England . . 455
Jastrow, J. Composite portraiture 165
K. Physics at Johns Hopkins 547
Kobelt, W. Colonization in Algeria 317
Last cruise of the Albatross 110
Late news from Alaska 95
Laws of temperature in the Austrian Alps 459
Leaves of the pitcher-plant. *Ill.* 296
LeConte, Joseph. Immortality in modern thought . 126
Legal ohm standards 436
Lesley, J. P. The president's address before the American association 168
Lick observatory. *Ill.* 186
Lumsden, Sir Peter, on the tribes upon the Afghan boundary. *Ill.* 69
M. Laying a cable 545
M., A. The mind-cure 543
M., C. S. Has man a tail? 92
McBride, T. H. Vegetable morphology a century ago. — Goethe 130
McIntosh, W. C. Phosphorescence of marine animals, 295
Massachusetts labor statistics 389
Medical missionary work in China. *Ill.* 570
Meeting of the American public health association . 511, 531
Mendenhall, T. C. The explosion at Flood Rock . 326
Mexican axoloti, and ts susceptibility to transformations, 90
Minot, C. S. The formative force of organisms . . . 4
A new endowment for research 144
Mode of admission into the Royal society 486
Mosquitoes *vs.* trout 197
National university 509
New theory of cohesion 274
Newton, H. A., Biographical sketch of. *Portrait* . . . 161
Nichols, W. R. Chemistry in the service of public health 208
Nipon central educational association 370
Nordenfelt submarine boat. *Ill.* 394
November meeting of the National academy of sciences . 443
Official scrutiny of the U. S. coast survey. 121
Origin of the cereals 73
Orton, E. Problems in the study of coal, with a sketch of recent progress in geology. 216
Osborn, H. L. Mimicry among marine Mollusca . . 9
Panama canal 341

285495

PAGE

Pasteur and hydrophobia . . . 396, 467
Paul, H. M. Recent gravity determinations in and near Japan . . . 319
Reform in our calendar . . . 324
Stars in rapid motion . . . 483
Timing the Flood Rock explosion . . . 325
Pickering, W. H. An attempt to photograph the solar corona without an eclipse . . . 131
Pickernell, F. A. The electric railway in New York. *Ill.* . . . 148
Poisonous waters in the Cocos or Keeling Islands . . . 369
Preliminary report of the commission on Spanish earthquakes . . . 393
Presidency of the Royal society of London . . . 442
President and Professor Agassiz . . . 302
Progress in metallurgy . . . 525
Pumpelly, R. Soils and health . . . 30
Puppet-shows in Java. *Ill.* . . . 251
Putnam, F. W. Man and the mastodon . . . 375
R., C. Recent progress in political economy . . . 479
Railways in Burmah . . . 552
Rathbun, R. A crab invasion . . . 135
Rauch, J. H. Chicago-River pollution . . . 27
Recent educational meeting in Boston . . . 351
Reed, Sir E. The forms of ships . . . 53
Reform in geographical orthography . . . 110
Reilly, F. W. How to deal with yellow-fever . . . 25
Relationships between dinosaurs and birds . . . 295
Remsen, Ira. City wells . . . 32
Resolutions of the American association concerning the coast survey . . . 204
Results of the Krakatoa eruption. *Ill.* . . . 291
Results of shad propagation on the Atlantic coast . . . 433
Richards, Ellen H. Science in common schools . . . 289
Riley, C. V. The song-notes of the periodical cicada . . . 264
Routes into the interior of western China. *Map* . . . 12
Ryder, J. S. A new system of oyster-culture . . . 465
Sanitation and science . . . 21
School for electrical engineering in Boston . . . 150
Science and the state . . . 325
Search for the gigantic bird of Madagascar . . . 418
Shaler, N. S. Humanism in the study of nature . . . 64
Shufeldt, R. W. Zuñian conceptions of animal forms as shown in pottery. *Ill.* . . . 266
Society for the promotion of agricultural science . . . 193
Steinen's explorations of the Xingu . . . 133
Sternberg, G. M. Disinfection . . . 328
The international sanitary conference at Rome . . . 101
Strong, E. E. The Caroline Islands. *Map* . . . 287
Tarr, R. S. The English sparrow . . . 416
Natural enemies of oysters . . . 392
Taussig, F. W. Prices from 1873 to 1884. *Ill.* . . . 365
Telephone in Paris. *Ill.* . . . 110
Telpherage. *Ill.* . . . 513
Thought-transferrence in Boston. *Ill* . . . 8
Todd, D. P. The future of the Lick observatory . . . 181
Toughened glass . . . 293
Toy, C. H. The new philology . . . 366
True, F. W. The American ferret. *Ill.* . . . 549
The British museum of natural history. *Ill.* . . . 127
Tyndall fellowships . . . 45
Typhoid-fever and its prevalence in autumn . . . 374
Use and abuse of learned societies . . . 351
Use of the French academy . . . 281
Utilization of by-products in charcoal burning . . . 506
Vanderpoel, S. O. Quarantines and their scientific value . . . 23
Ward, L. F. A convenient system of river nomenclature . . . 321
Water-supply of Breslau . . . 34
Water-supply for New York . . . 72
Webb, J. B. The second law of thermodynamics . . . 212
Western school of botany . . . 21
Whitfield, R. P. An American Silurian scorpion. *Ill.* . . . 87
Who should be superintendent of the U. S. coast survey . . . 241
Wilder, B. G. Educational museums of vertebrates . . . 222
Wilkinson, C. S. Geological changes in New South Wales . . . 320
Winlock, W. C. Comets II and III of 1884. *Ill.* . . . 47
Wrangell, Admiral Baron F. von . . . 417
Wright, A. W. Electrical measuring instruments . . . 151
Yacht Puritan. *Ill.* . . . 168

BOOK REVIEWS.

PAGE

American society for psychical research, First report of . . . 155
Berlin exhibition of hygiene in 1882–83 . . . 36
Billings's Animal diseases and public health . . . 38
Bolton's Catalogue of scientific serials . . . 256
Caird's Social philosophy and religion of Comte . . . 354
Cassino's Standard natural history . . . 74
Challenger report on the stalked crinoids . . . 138
Comfort and longevity . . . 37
Congress, Fourth, of German physicians. By *M. A. S.* . . . 395
Cooke's Scientific culture . . . 114
Cornil and Babes's Bacteria . . . 77
Cruise of the Corwin . . . 425
Darwin's biography. . . . 276
Doctors and their work. By *M. A. S.* . . . 571
Doolittle's Practical astronomy . . . 404
Edible and poisonous fungi . . . 277
Edwards's Butterflies of North America . . . 307
Ellis's West African islands . . . 307
Ermengem on the cholera microbe . . . 154
Experiments in memory. By *W. J.* . . . 198
Fifth volume of Ohio geology . . . 257
Geological survey of Canada . . . 521
Geology of the Virginias . . . 17
Glaciers and their *rôle* in nature. *Ill.* . . . 56
Goodale's Text-book of botany . . . 471
Hornaday's Travels in Borneo . . . 472
Horse-breeding . . . 447
Infant psychology. By *J. Jastrow* . . . 435
Infectious diseases . . . 299
Insular floras. By *A. G.* . . . 297
Jagnaux's Traité de minéralogie . . . 16
Joest's Around Africa. *Ill.* . . . 115
Johnson's Surveying . . . 356
Kittler's Electrotechnical handbook . . . 447
Kratter's Alpine cretinism . . . 484
Langley's Temperature of the moon's surface. By *H. M. Paul* . . . 412
Last year's meeting of the American association . . . 197
Lippe's Psychological studies. By *W. J.* . . . 308
Localization of functions in the brain . . . 379
Lucy-Fossarieu's Ethnography of antarctic America. By *H. Hale* . . . 92
Malthus and his work . . . 567
Martineau's Types of ethical theory. By *F. G. Peabody* . . . 137
Melon's From Palermo to Tunis . . . 447
Methods of bacteria culture . . . 97
Methods of teaching political economy . . . 534
Mexican ethnology . . . 405
Newcomb's Political economy. By *E. J. James* . . . 470
North Carolina coal-fields. By *I. C. Russell* . . . 548
Origin of mediæval universities . . . 460
Permian reptiles of Bohemia . . . 97
Physiology of the brain. By *C. S. Minot* . . . 521
Plunkett's Household sanitation . . . 57
Political science in France . . . 482
Practical botany . . . 98
Pre-Columbian history of Guatemala . . . 514
Recent Challenger monographs. By *G. B. Goode* . . . 526
Remsen's Organic chemistry . . . 76
Report of the Point Barrow station . . . 446
Rescue of Greely . . . 278
Rohe's Hygiene . . . 278
Russia under the tzars . . . 355
Schwatka's Nimrod in the north . . . 554
Some works on geology and geography . . . 298
Stanley's Kongo. *Portrait, map* . . . 177
Sumner's Economic essays . . . 111
Theory of volcanoes. By *C. E. Dutton* . . . 255
Three physical text-books . . . 96
Thurston's Friction and lost work . . . 275
Upton, Gen. Emory, Life of . . . 404
Wallace's Bad times . . . 553
Waring's House-drainage . . . 39
Washburn observatory . . . 461
Wight's Maxims of public health . . . 75
Windmill as a prime mover . . . 258
Work of the Challenger expedition: I. General and physical, 15; II. From a zoölogical stand-point, 54; III. Geologically viewed . . . 137
Wuelker's History of Anglo-Saxon . . . 487
Zimmermann's Atlas of plant-diseases . . . 156

AMERICAN ASSOCIATION NUMBER, 201.
ASTRONOMICAL NOTES, 95, 310, 333, 358, 381, 405, 427, 448, 473, 489, 516, 556.
CALENDAR OF SOCIETIES, 410. (See also advertising pages.)
COMMENT AND CRITICISM, 1, 41, 61, 81, 141, 261, 301, 325, 349, 373, 397, 419, 441, 463, 485, 507, 529, 551.
GEOGRAPHICAL NOTES, 50, 71, 134, 311, 356, 380, 426, 448, 488, 515, 554.
LETTERS TO THE EDITOR, 2, 42, 63, 82, 103, 123, 142, 162, 183, 242, 262, 283, 316, 335, 362, 384, 407, 431, 453, 478, 495, 517, 538, 558.
METEOROLOGICAL NOTES, 556.
NEW BOOKS, 356, 426.
NOTES AND NEWS, 18, 40, 58, 78, 98, 116, 139, 157, 180, 199, 238, 258, 278, 300, 312, 333, 348, 359, 371, 382, 406, 418, 428, 449, 459, 462, 474, 484, 490, 517, 535, 550, 557, 572.
PUBLICATIONS RECEIVED AT EDITOR'S OFFICE, 388. (See also advertising pages.)
RECENT PROCEEDINGS OF SOCIETIES, 387, 409. (See also advertising pages.)
SCIENCE SUPPLEMENT, 317, 341, 365, 389, 411, 433, 455, 479, 499, 521, 543, 565.
SPECIAL CORRESPONDENCE: *Boston Letter*, 384, 476; *London Letter*, 334, 429, 493, 537; *St. Petersburg Letter*, 430, 492; *Washington Letter*, 314, 361, 383, 453, 491, 536.

LIST OF ILLUSTRATIONS.

PAGE

Afghan tribes, some types of 70
Alabama state signal service, five flags of the 200
American association for the advancement of science, composite portrait of officers of the 167
Andromeda, spectrum of the great nebula in 262
Bala Murghab, gateway of 69
Ben Nevis meteorological observatory 460
Bernard, Claude, statue of 117
Boat, Nordenfelt submarine, trial of the, at Landskrona, Sweden 394
Bridge, Arizona natural 67
Caffre, Natal 115
China, western, map showing routes into interior of, 12; medical missionary work in 570
Color associations with the months (2 figs.), 142, 143; and other associations (4 figs.) 243, 337, 338
Comets II and III of 1884 (5 figs.) 47, 48, 49
Darwin, Charles, portrait and signature of 11
Doctor of the old school, a French 40
Dome at Nice, section of floating (2 figs.) 80
Edison, Thomas A., portrait and signature of 146
Eye, development of the (3 figs.) 194, 195
Ferret, the American 550
Forge, an African 347
France, map of, showing average height of inhabitants . 523
Glacier, Rhone, map showing recession of 56
Gray, Asa, vase presented to, on his seventy-fifth birthday, 465
Heads, average measurements of three classes of 73
Indo-China, map showing proposed railways in, 107; Pillar Rock in the Meh Ping, 107; Shan house at Kiang Hsen, 108; ruins at Kiang Hsen, 109; map of, showing river-sources 400
Java, behind the scenes at a puppet-show in 251
Jews, composite photograph showing racial characteristics of (5 figs.) 323
Krakatoa eruption, results of the (3 figs.) 292, 293
Land-slide on Owl's Head, the recent 86
Lick observatory, the (5 figs.) 187, 188, 189, 190, 191
Luxor, excavations going on in the court yard of the temple of 371
Micronesia, map of 288

PAGE

Micropterus salmoides (Lac.) Gill, malformed 243
Mola rotunda 104
Monument of the first duke of Sutherland at Lilleshall, Eng. 238
Mortality, diagram exhibiting comparative, in Rhode Island, 512
Mounds, effigy, in Iowa 454
Museum, Agassiz, at Cambridge, plan of, 423; of natural history, the new British, on Cromwell Road, main façade of 129
Newton, Prof. Hubert Anson, portrait of 161
Oxygen, Cailletet's apparatus for the liquefaction of . . 51
Pitcher-plant, leaves of the (4 figs.) 296, 297
Prices from 1873 to 1874 366
Puritan, the yacht (2 figs.) 168, 169
Railway, the electric, in New York (2 figs.), 148, 149; an electric, between Frankfort and Offenbach 240
Rudbeckia, an abnormal 103
Scorpion, an American Silurian 88, 183
Stanley, Henry M., portrait of 179
Sulu maiden 115
Tablet, the Davenport 564
Telephone, use of, for military purposes 239
Telephones, map of Paris, showing the distribution of . . 111
Telpherage (4 figs.) 513, 514
Thought-transferrence, reduced facsimile of drawings showing some evidence of so-called 8
Turkish territory, sketch map to illustrate changes in, by the treaties of San Stefano and Berlin 304
Universities, German, map showing the distribution of . 245
Zuñian conceptions of animal forms as shown in pottery (4 figs.) 267, 268

Africa, central, map of, based on Stanley's map of the Kongo Free State . . . . . opposite 163
Agassiz, L., portrait and signature of . . . . opposite 344
Bulgaria, map showing regions affected by the recent revolution in . . . . . opposite 303
India, further, map of, showing regions involved by the troubles in upper Burmah . . . . . opposite 399
Ship-railway, Tehuantepec, map and illustrations of, opp. 33
Washington, three new portraits of . . . . . opposite 507

ERRATA.

Page 140, col. 1, 24th line from top, for 'Aucon' read 'Ancon.'
" 322, " 1, 9th line from bottom, for 'wild' read 'mixed.'
" 322, " 2, 7th line from top, for '2 ≤' read '0.2 ≤.'
" 323, " 1, 16th line from bottom, for 'Moyars' read 'Magyars.'
" 324, " 1, 23d line from top, for '*Cobanim*' read '*Cohanim*.'
" 330, " 1, 20th line from top, for 'important' read 'impotent.'
" 331, " 1, 19th line from top, for 'Braun' read, Bronn.'

Page 419, col. 2, 14th line from bottom, for 'plead' read 'pleaded.'
" 427, " 1, 1st line from top, for 'Catherina' read 'Catharina.'
" 441, " 2, 22d line from bottom, after 'collections' insert 'of insects.'
" 473, " 2, 22d line from top, after 'M. Gully' insert '(*Ciel et terre*, Oct. 1, 1885, p. 355).'
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COMMENT AND CRITICISM.

IT MAY NOW BE SAID to be the fashion for individuals of great wealth to make bequests to found new institutions of learning, or in general to help on such institutions already in existence, and in particular to endow specific departments of research. But it is much more than a fashion. We may presume that those making such bequests desire, in large majority, that the greatest good shall come from their gifts — if not in the advancement of knowledge, then in its diffusion among men. To be sure, we have many princely donations nowadays, which, while they provide for the worthiest of objects, are paraded in the public prints as if ephemeral notoriety were all the donor thought of. But this sort of bequest is growing increasingly less, and the ultimate substantial good is coming to be regarded uppermost.

It is indicative of a solid growth in our country, that an increasing proportion of its wealth is turned into the channels of education and science. What it took European nations hundreds of years to find out, the shrewdest of our public benefactors are fully aware of, — that no earthly institutions are so stable and enduring as the great colleges and universities; that solid endowments in these institutions have a lease of life which not even nations themselves can be sure of; and that funds thus deposited preserve their integrity when other forms of investment undergo complete dissipation. The chief institutions of higher education in America have an excellent record to exhibit in the management of the funds intrusted to their guardianship. They are not thought of ordinarily as at all different from other institutions and corporations which exist solely for self-remunerative interest. No college or university exists to make money. The income of such institutions is very largely derived from funds which have been given to them; and while fees are received, and make up a part of the income, they expend all they receive, as a rule, and only hope to receive more that they may give more. So, also, it is with all departments and organizations for scientific research.

'The more one has, the more one receives,' seems to be exemplified in the finances of our greatest university, the observatory of which has just received a bequest of nearly three hundred thousand dollars from the will of the late Mr. Robert Treat Paine of Brookline, Mass. The observatory receives one-half of this amount at once, — a sum large enough to enable the early resumption of the important researches which, through lack of funds, it became necessary to discontinue at the close of last year, — the remainder on the death of his widow. Mr. Paine died recently, at the advanced age of eighty-one years. Although not a professional astronomer, he was well known to all the astronomers of the present generation. His immediate contemporaries in the science have all, we believe, passed away. Mr. Paine took special interest in the prediction and observation of solar and lunar eclipses; and the persistency with which he followed these phenomena, even in late years, makes it probable that he had observed more eclipses than any other person. Also he made meteorological observations of great value; and his record of barometric and thermometric readings at a

single spot in Boston is said to be continuous for more than fifty years.

While Mr. Paine's bequest is at present chiefly noteworthy as enabling one important institution, temporarily embarrassed, to proceed with its work, and is thus most timely, it is also worthy of remark that it ranks high among specific bequests by scientific men themselves. That they rarely make large bequests, we presume to be no fault of their own, as but few of them ever come into the possession of great wealth, and fewer still are able to accumulate much more than enough to provide respectable support for their families. That Mr. Paine has done much more than this, is evident from the magnitude of his bequest; and it is gratifying to see so deserving an institution as the observatory of Harvard college come into the possession of an endowment copious enough to insure not only the continuance of its remarkable activity during recent years, but a considerable growth into new lines of research.

The fiat has gone forth that in several of our cities the various telegraph, telephone, and electric-light wires must go underground within a very few months, and in New York a commission is shortly to be appointed to see that the legislative enactments are carried out. There are probably few competent persons, who have carefully and dispassionately considered the subject, who are not satisfied that an attempt to hurry this matter, and subject the wires to a premature burial, is, to say the least, extremely unwise. That it is scientifically practicable to work telegraph and telephone wires for short lengths underground, is unquestionable; but few persons who have not investigated the subject realize the great practical difficulties involved, and the very large expense required to insure satisfactory results. With the high-tension currents used in arc-lighting, additional difficulties are encountered that have not yet been satisfactorily surmounted. That the rapid increase of overhead wires is productive of much annoyance and danger, is evident to all; and even those most averse to legislation feel that most of the wires must eventually be placed underground. But in this, as in all matters which are still in an experimental stage, the only safe maxim is to hasten very slowly.

A recent publication of the Society for the promotion of agricultural science — the second made by the society — contains the papers read at the Minneapolis meeting in 1883, and the Philadelphia meeting in 1884, together with a lecture by Dr. J. H. Gilbert on agricultural investigations, and lists of members of the society and of American experiment-stations. Thirteen papers were presented, — seven in 1883, and six in 1884. Some of these are of scientific interest, while it is difficult to see how others serve to advance agricultural science. The object of the society is a most praiseworthy one; but we doubt whether at present enough really scientific work is done in this country in the field of agriculture to render such a society necessary as a means of publication, however useful it may be as a means of bringing together for consultation and discussion those interested in agricultural science.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Velocity and sediment.

Mr. B. M. Harrod, in his note in *Science* of June 13, says that observations do not confirm the suggestions of Mr. Login as to an intimate relation between velocity and sediment. While stating negations, he might well have added, Neither does observation support the speculative dogmas laid down as fundamental truths by the Mississippi-River commission in its reports; for the Login notion pervades those reports, it having been adopted by Capt. Eads, and Capt. Eads's views having been adopted by the commission.

Mr. Harrod now amplifies a statement of Capt. Brown that the controlling influence of the Missouri over silt movement in the Mississippi is felt at the passes thirteen hundred miles below. As an interpretation of observations, the statement and its amplification are questionable.

Proceeding in his effort to throw the Login-Eads notion overboard, Mr. Harrod cites facts concerning erosion below Cairo to show that the more heavily silt-laden water on the west side of the river is also more active as an agent of erosion than the clearer water on the east side. Would not a muddy subject be clearer, if the idea of erosion as the cause of

silt-laden condition had been suggested, rather than an argument based on the implied converse? The fact is evident, that the water on the west side is more heavily laden because erosion on that side is most active. This, of course, directs the search for the cause of erosion in another direction than the one which those who would fain persuade themselves and others that the improvement of the Mississippi is possible by the principles and methods now employed, would choose to take.

The variations of silt-burden at the mouth of the Mississippi, attributed to the influence of Missouri-River water and the erosions below Cairo, have their final explanation in dynamic conditions which may be local.

The quantity of material delivered by the Missouri into the Mississippi may be nearly equivalent to the quantity discharged by the Mississippi into the Gulf for any period without establishing a presumption of identity; since that quantity is small, compared with the total moved, as the result of erosions of bank and scour in bed, in the thirteen hundred miles between the entrance of the Missouri and the Gulf. No direct evidence has yet been obtained that any particle of sand has ever traversed the thirteen hundred miles without one or many rests; but there is much evidence that transportation of sediment is by intermittent steps, times of rest being far in excess of motion. That the quantity in motion varies enormously in a few miles' distance was shown by the Fulton observations of 1879 and 1880, and the variation in quantity was clearly accounted for by observed local erosions and deposits.

Erosions and the consequent silt movement are due to an excess of energy in the stream (energy is a function of mass and fall or slope) beyond that necessary to overcome bed-resistances, mostly friction. The excess must be expended where it occurs; and the work done in the way of destructive action on bed and bank, and in the transportation of eroded material, measures the excess. The amount of surplus energy varies with time and place; so, also, the work done.

To trace any instance of work to its cause is not possible or necessary. Apprehension of the fact that erosion and silt-transport, with the consequences, — a shifting channel and uncertain elevation of surface for a given volume, — are due to dynamic conditions dependent upon volume of water and its absolute height above sea-level, on the one hand, and the character of channel, its length, form, and material, on the other, will be a safeguard against many errors of interpretation, of which Mr. Harrod's note affords two examples. ROBERT E. MCMATH.

St. Louis, June 17.

Korean curios.

I enclose an extract from a letter from Lieut. G. C. Foulke, U. S. navy, of the U. S. legation at Seoul, Korea, in which he kindly gives more exact information in reference to my article in *Science*, vol. iv. p. 172, and also in regard to Prof. E. S. Morse's criticism on said article in *Science*, vol. iv. p. 270.

GEORGE F. KUNZ.

Min Yong Ik is a blood nephew of the Queen of Korea. His father gave him for adoption to Min Thai Ho, who was killed in the conspiracy of December, 1884. He is stated by orientals generally to be *by affinity* a *prince*, and so generally titled. The present king and queen have one child, a son, — the crown prince: by Korean rule, Min Yong Ik ranks next to him.

Min Yong Ik's thumb-ring is a *thumb-ring:* it is not in the least like an archery thumb-guard, which I never saw an *officer* have or use on any occasion, nor do they have or use such. Min's jade thumb-ring is one of a class of articles, among which are short strings of shell-beads, pieces of amber, etc., very commonly owned by Korean officers, as many persons use canes at home to occupy the hands to play with.

The gold ornament Min wore was a button indicating his rank: it was (as it must be) attached by a black silk cord to a hair frontal band.

I have heard from many people that at Kurngang San, on the east coast of Korea, were columns of stone more than six times the height of a man. Some said they were crystals; but others (and one eye-witness) do not speak of them as such. Probably the columns below the water in the sea presented that appearance. Most people say there were tree-like shaped stones. Kurngang San is the place spoken of by Prince Min to Mr. Kunz.

Professor Morse is quite correct in saying the social customs of the country would interfere with Min's bringing his wife to America. Min often said he intended to bring her, etc.; but his talk was perfect nonsense, for he never meant it.

An indian paint-cup.

While searching for Indian remains on an island in the Susquehanna, I found a paint-cup which is somewhat different from the ordinary. In place of a water-worn pebble which has had a natural hollow on one side, — and which is, I believe, the material invariably used, especially in the east, — this is made from a fragment of sandstone, which has been hollowed out entirely by artificial means. Some of the powdered oxide of iron still remains in the cup, and, if moistened, answers very well for a coloring-matter. The site where I found the cup has furnished quite a number of relics, and was very probably the rendezvous of fishing-parties. HARVEY B. BASHORE.

West Fairview, Penn.

Premature appearance of the periodical cicada.

The communication of Prof. Lester F. Ward on this subject in *Science* (v. 476) will no doubt surprise other members of the Biological society of Washington as much as it did the undersigned.

Memory of a sound after the lapse of many years is untrustworthy, as a rule; and I was unwilling to accept as an established fact the statement of such an abnormal occurrence, which Professor Ward based solely on such memory. Yet I nevertheless endeavored to give reason for its possibility, there being a vast difference between a possibility and an established fact. Professor Ward then effectually weakened his testimony by evidence of faulty memory as to the season when Cicada septendecim was heard by him when a boy.

His evidence was rejected by me for that reason, and for the further reason, that, upon his own ground of rejecting inexpert testimony in memory of a visual impression as to hybrid oaks, we must reject his inexpert testimony in memory of an auditory impression as to Cicadas. I nowhere pronounced his Virginia observations 'wholly worthless,' nor the occurrence 'impossible as contrary to all canons of entomology.'

Professor Ward, in his private conversation with me, made no attempt to describe the notes of October last, but simply affirmed his recollection of them as similar to those of C. septendecim. His description in *Science* is of one of the notes of the species, and he seems to be ignorant of the fact that Cicada septen-

decim has several very distinct and variable notes. He has probably been misled by the abnormal condition of things the present year in the District of Columbia, where the English sparrow has so prevented the full maturity of the males, and so decimated their ranks, that the more characteristic noises, and those most apt to be recollected, have scarcely been heard. This has been a common remark among entomologists, who recollected former visitations in other parts of the country.

Finally, Professor Ward will convince no one that I was ever guilty of speaking of the note of Cicada pruinosa as 'precisely like' that of C. septendecim, though the mature and louder note of the latter much more nearly resembles that of the former than he seems to imagine. C. V. Riley.

Washington, D.C., June 17.

Periodical cicada in Massachusetts.

Among the localities given by the earlier writers for the present septendecim brood of the periodical cicada, are Fall River and the south-eastern portion of Massachusetts. These need confirmation; as, so far, no reports have been received from Massachusetts the present year. There is a brood which appears at Fall River one year later. I shall be glad to get confirmation either of the absence or presence of the insect the present year from the readers of *Science* in south-eastern Massachusetts. C. V. Riley.

Washington, D.C.

Height of land in Connecticut.

The ninth and last edition of the 'Encyclopaedia Britannica' has the statement that there is no land in Connecticut 'above a thousand feet in elevation.' Statements equivalent to this will be found also in 'Appletons' American cyclopaedia' and in 'Johnson's cyclopaedia.' A survey by an engineer, Mr. G. M. Bradford, in 1873, which was based on the survey of the Connecticut western railroad, gives the heights of several points in the north-western part of this state, and these results cannot be much in error. I am indebted to Mr. Henry Norton of Goshen, Conn., for the communication of these heights. It will be remembered that Salisbury is the north-western town of the state, and that east of it, joining Massachusetts, are Canaan and Norfolk: Goshen joins Norfolk on the south. The following are some of the heights above sea-level: —

	Feet.
Ivy Mount (Goshen)	1,642
Haystack Mount (Norfolk)	1,672
Bald Mount (Norfolk)	1,770
Bradford Mount (Canaan)	1,910
Bear Mount (Salisbury)	2,100
Brace Mount (Salisbury)	2,300

It may be thought hardly worth while to dispute any statement made in a cyclopaedia; but, having been born and reared among the beautiful hills of Connecticut, I dislike to see them diminished to one-half their height, even by such a ponderous authority as the 'Encyclopaedia Britannica.'

Asaph Hall.

June 27.

The ginkgo-tree.

In *Science*, No. 124, Mr. L. F. Ward states that the Frankfort, Ky., ginkgo-trees are the only ones known to him in the United States that have borne fruit. Permit me to say that a group of these trees in Central Park, New-York City, have borne fruit to my knowledge for the past six years, and that in great abundance. R. P. Whitfield.

Amer. mus. nat. hist.,
June 24.

THE FORMATIVE FORCE OF ORGANISMS.

The assertion is safe, that the majority of biologists incline at present to explain the forming of an organism out of its germ upon mechanical principles. The prevalent conception is, that the forces of the ovum are so disposed that the evolution of the adult organism is the mechanical result of the predetermined interplay of those forces. The object of the present article is to point out that this conception is inadequate, and must be at least supplemented, if not replaced, by another view; namely, that the formative force is a generally diffused tendency, so that all parts inherently tend to complete, by their own growth and modification, the whole organism, — a fact which finds a legitimate hypothetical expression in Darwin's doctrine of pangenesis. The nature of the view here advanced will become clearer upon consideration of the evidence upon which it is based, and which is adduced below. The evidence that the formative force is diffused through all parts falls under three heads: 1. The process of regeneration in unicellular and multicellular bionts; 2. The phenomena of the duplication of parts; 3. All forms of organic reproduction. Let us briefly consider these categories.

1. *Regeneration.* All living organisms have to a greater or less degree the ability to repair injuries: indeed, we must regard the power of regeneration as coextensive with life, but the capacity varies enormously in the different species. In man the power is very small, though more extensive than is generally realized. Among annelids are species the individuals of which may be divided in two, and each piece can regenerate all that is needed to render it a complete worm. We sometimes see a small fragment of a plant, a single switch of a willow for instance, regenerate an entire tree, — roots, trunk, branches, leaves, flowers, and all. In the last instance a few cells possess a latent formative force, which we recognize by its effects, but cannot explain. We perceive, therefore, that each individual has, as it were, a scheme or plan of its organization to which it strives to conform. As long as it actually does so, the cells perform their routine functions; but when an injury destroys or removes some portion, then the remaining cells strive to conform again to the complete scheme, and to add the missing fragment. The act of regeneration of lost parts strikes the imagination almost as an intelligent pursuit by the tissues of an ideal purpose.

Our knowledge of the regenerating power

has recently received important extensions through the noteworthy experiments of Nussbaum [1] and of Gruber,[2] who have demonstrated independently the possibility of dividing unicellular animals so that each piece will regenerate the missing parts. In this manner the number of individuals can be artificially multiplied. For example: Nussbaum divided a well-isolated Oxytricha into two equal parts, either transversely or longitudinally, and found that the edges of the cut became soon surrounded with new cilia. Although some of the substance of the body, or even a nucleus, was lost through the operation, yet, by the following day, the two parts converted themselves into complete animals with four nuclei and nucleoli (*nebenkerne*) and the characteristic ciliary apparatus. "The head-piece has formed a new hind end; the right half, a new left half." The new-formed duplicate Infusoria multiplied subsequently by spontaneous division. From one Oxytricha cut in two, Nussbaum succeeded in raising ten normal animalcules, which subsequently all encysted. After an unequal division, the parts are both still capable of regeneration, but parts without a nucleus did not survive; which suggests that the formative energy is in some way bound up with the nucleus. But nucleate pieces may break down. Thus all attempts at artificial multiplication of the multinucleate Opalina failed, although the division of Actinosphaerium had been successfully made by Eichhorn as long ago as in the last century. Pelomyxa palustris has been successfully divided by Greef, and Myxastrum radians by Haeckel.

Gruber (*l. c.*, p. 718) describes his experiments with Stentor: "If one divides a Stentor transversely through the middle, and isolates the two parts, one finds on the cut surface of the hind part, after about twelve hours, a complete peristomial field with the large cilia and buccal spiral newly formed. On the other hand, the piece on which the old mouth is situated has elongated itself backwards, and attached itself in the manner peculiar to these Infusoria. If one has made a longitudinal section, so that the peristom is cut in two, then the peristoms both complete themselves, and the lateral wounds heal over. I have repeatedly separated by trans-section pieces considerably less than half of the original Stentor, and these have also regenerated themselves to complete animals." Gruber, too, observed that artificially divided Infusoria were capable of subsequent spontaneous multiplication. If the section is not very deep, there may arise double monsters; but here, just as in spontaneous divisions, as long as there remains an organic connecting-band, the two parts act as one individual, showing that the nervous actions are not restricted to determined paths. Gruber also adds, that two divided pieces may be reunited, if they are brought together again quickly enough. The observation thus briefly announced is of such extreme interest and importance, that the publication of the full details of the experiment will be eagerly awaited. Gruber adds, that at present we cannot go much beyond the proof of the existence, to a high degree, of the regenerative capacity in unicellular organisms. He also makes the significant observation, that, in the Protozoa, we have to do foremost with changes of function; in the Metazoa, with growth also.

2. *Duplication of parts.* In these anomalies we find an organ which, although an extra member, yet still conforms to the type of the species. For example: a frog is found with three posterior limbs; dissection proves the third leg to agree anatomically with the typical organization of the frog's hind leg. In determining the importance to be attributed to this evidence, it should be remembered, on the one hand, that these instances are by no means unusual; on the other, that the agreement with the normal structure is not uniform.

3. *Asexual reproduction.* When a species multiplies by fission of any kind, we must assume that each part, after division, possesses the formative tendency, since we see it build up what is necessary to complete the typical organization of the individual. Again: a bud of a hydroid or polyzoon, although comprising only a small part of the body, is equally endowed with this uncomprehended faculty. In pseudova we reach the extreme limit: in Aphis, for example, the parent gives off a single cell, the capacity of which to produce a perfect and complicated individual, fully equals the like capacity of a hydroid bud or of half a worm.

The evidence forces us to the conclusion that the formative force or cause is not merely the original disposition of the forces and substances of the ovum, but that *to each portion of the organism is given*, 1. *The pattern of the whole organism;* 2. *The partial or complete power to reproduce the pattern.* The italicised formula is, of course, a very crude scientific statement, but it is the best which has occurred to me.

[1] M. NUSSBAUM. *Ueber spontane und künstliche zelltheilung.* Sitzungsb. Niederrhein. ges. nat. u. heilkunde. Bonn, Dec. 15, 1884. [I regret very much that I know this paper only by Gruber's abstract.]

[2] A. GRUBER. *Ueber künstliche teilung bei Infusorien.* Biolog. centralbl., iv. (No. 23) 717–722.

The formative force, then, is a diffused tendency. The very vagueness of the expression serves to emphasize our ignorance concerning the real nature of the force. In this connection, I venture to insist upon the fact that we know little or nothing concerning any of the fundamental properties of life, because I think the lesson of our ignorance has not been learned by biologists. We encounter not infrequently the assertion that life is nothing but a series of physical phenomena; or, on the other hand, what is less fashionable science just now, that life is due to a special vital force. Such assertions are thoroughly unscientific; most of them are entirely, the remainder nearly worthless. Of what seem to me the prerequisites to be fulfilled before a general theory of life is advanced, I have written elsewhere.[1]

Charles S. Minot.

UNDERGROUND WIRES.

During the last few years the number of electric wires in all of our large cities has rapidly increased, especially since the introduction of the telephone and the electric light; and the probability is that the next few years will show a further large increase. If these wires run on poles, they not only disfigure the streets, but seriously interfere with the operations of firemen, as we have repeatedly seen during the last few years. A cobweb of wires supported on housetops requires the line-men to continually tramp through the houses and over the roofs, causing annoyance to the tenants, and damage to the buildings. Moreover, wires fixed to housetops are subject to removal at the whim of the owner, and they have to be continually removed from building to building as the good will of each owner is exhausted. Again: overhead wires, whether placed on poles or housetops, are continually coming in contact with each other, causing annoyance and danger; and an extra heavy rain or sleet storm so entangles and breaks them as to entirely interrupt communication. The annual cost of repairs of overhead wires in cities is not less than thirty per cent of the first cost of construction.

In almost all of the large cities the question is being asked, Why cannot these wires be gathered into cables and buried, along with the gas and water pipes, under the streets? In answer, it is proposed to review briefly the technical difficulties that arise, and to show how they may be and are overcome. It is proposed, further, to compare the cost of construction and maintenance of overhead wires with the cost of construction and maintenance of underground cables, and thus to see which is desirable from economical considerations.

There are two reasons, apart from the difficulty of securing good insulation, why underground lines are comparatively inefficient: —

1. If an electric conductor be brought near to a large mass of conducting-matter, as is a wire when it is taken down from a pole and buried in the earth, there appears in the current the phenomenon of retardation, by which each signal, instead of being sharp and distinct, is partly kept back, so that it overlaps and mingles with the next. The result is to limit the speed of working of the apparatus, or, if, like the telephone, it be an apparatus in which the currents are necessarily extremely frequent, to confuse and destroy the signals altogether.

2. The second difficulty is called induction, and is noticed when two or more wires are run side by side and near together, as they necessarily are in an underground cable. If the signals on one wire of such a cable be sharp and quick, they cause facsimile signals on all of the neighboring wires; and this, too, though the insulation may be absolutely perfect. The result of this phenomenon is, that messages sent over one wire are liable to be received on all of the other wires; and in telephony each person can easily overhear all that the others are saying.

Fortunately, however, both of these difficulties vary with the electrical qualities of the cable; and while I have seen cables of a thousand feet, over which it was difficult to talk, and in which the cross-talk was nearly as loud as the direct conversation, on the other hand, I have conversed easily over an underground cable extending from Paris to Orleans, eighty-five miles; and this, too, while other parties similarly separated were talking over other conductors of the same cable. There was absolute secrecy.

Last summer I visited France and Germany, and made, together with Mr. Berthon (chief engineer of the French telephone company), Mr. Cäel (chief engineer of the French government telegraph), and Herr Guillaume (constructor of the underground lines of the German empire), a series of telephone experiments on underground lines, varying from 5 to 100 miles in length, from 2.87 to 48 ohms resistance, and from 0.06 to 0.35 microfarads capacity per mile.

These experiments furnish us with ample

[1] C. S. Minot. *On the conditions to be fulfilled by a theory of life.* Proc. Amer. assoc. adv. sc., xxviii. 411.

data from which to deduce the requisites of any cable, in order that it may transmit speech, and without cross-talk from the neighboring conductors. These are briefly as follows: —

1. Good conductivity.

2. High insulation; for without this the current leaks from one conductor to the others, giving rise to cross-talk; and it is possible to talk by direct leakage between two conductors whose insulation is several million ohms.

3. Low specific inductive capacity; for, the greater the capacity, the greater the retardation, and the greater also the cross-talk due to induction.

Below is a table showing the specific inductive capacity and insulation of various insulators. The measurements were all made on a wire 0.05 of an inch in diameter, coated with insulation to a thickness of 0.10 of an inch.

Cable.	Maker.	Insulation per mile in meghoms.	Specific inductive capacity in microfarads.
Gutta-percha,	Siemens Bros., London.	190	4.2
India-rubber,	Rattier, Paris.	170	3.7
Kenti . . .	A. G. Day, New York.	150	4.0
Faraday . .	Faraday cable-works, Cambridge, Mass.	15,000	1.6
Patterson . .	Western electric company, Chicago.	450	3.1
Brooks . .	David Brooks, Philadelphia.	–	2.8

Let us take a special case, and compare a gutta-percha cable having a specific inductive capacity of 4.2 with a Faraday cable of 1.6. The table predicts that we can talk three times as far with the latter as with the former, and experiment shows that we can. Again: the cross-talk on the gutta-percha cables ought to greatly exceed that on a Faraday cable; and experiment has shown, that, while conversation over a two-mile gutta-percha cable was continually disturbed by existing cross-talk, conversation was carried on over a similarly constructed Faraday cable five miles in length without the cross-talk being appreciable.

By proper attention to the electrical qualities, then, we may talk underground a much greater distance than we shall ever have reason to in any city system, and this without cross-talk from the neighboring circuits.

We have seen that telegraph and electric-lighting currents are not subject to the technical difficulties we have been discussing, and that, provided good conductivity and good insulation are assured, it is with them purely a question of expense. Let us, then, determine the relative expense of overhead and underground wires.

Suppose we have a large city with a telegraph-office near the centre, and that it is desired to carry a hundred wires to the city limits, say, three miles distant. Let us suppose that the wires for the first mile rest on housetops, and for the remainder of the distance on poles. The cost will be: —

35 roof-fixtures	@	$45	$1,575
80 poles, with arms, etc.	@	65	5,200
300 miles No. 9 wire	@	16	4,800
Stringing 300 miles wire	@	8	2,400
			$13,975

Underground, the cost would be: —

6 miles (50 conductors) No. 17 lead-covered cable	@	$3,000	$18,000
3 miles trenching, troughing, laying, and refilling	@	2,000	6,000
			$24,000

That is, the relative first cost of an overhead and an underground line, to do the same work, would be, say, $14,000 and $24,000.

The same conclusion will hold true for telephone-wires, provided we confine ourselves to the problem of running out from the central office, by fifty or a hundred conductor cables, to a large number of distributing-points so situated about the city that any subscriber would be easy of access, by a short overhead line, to one or another of them; and this is the problem that really occurs. So much for construction.

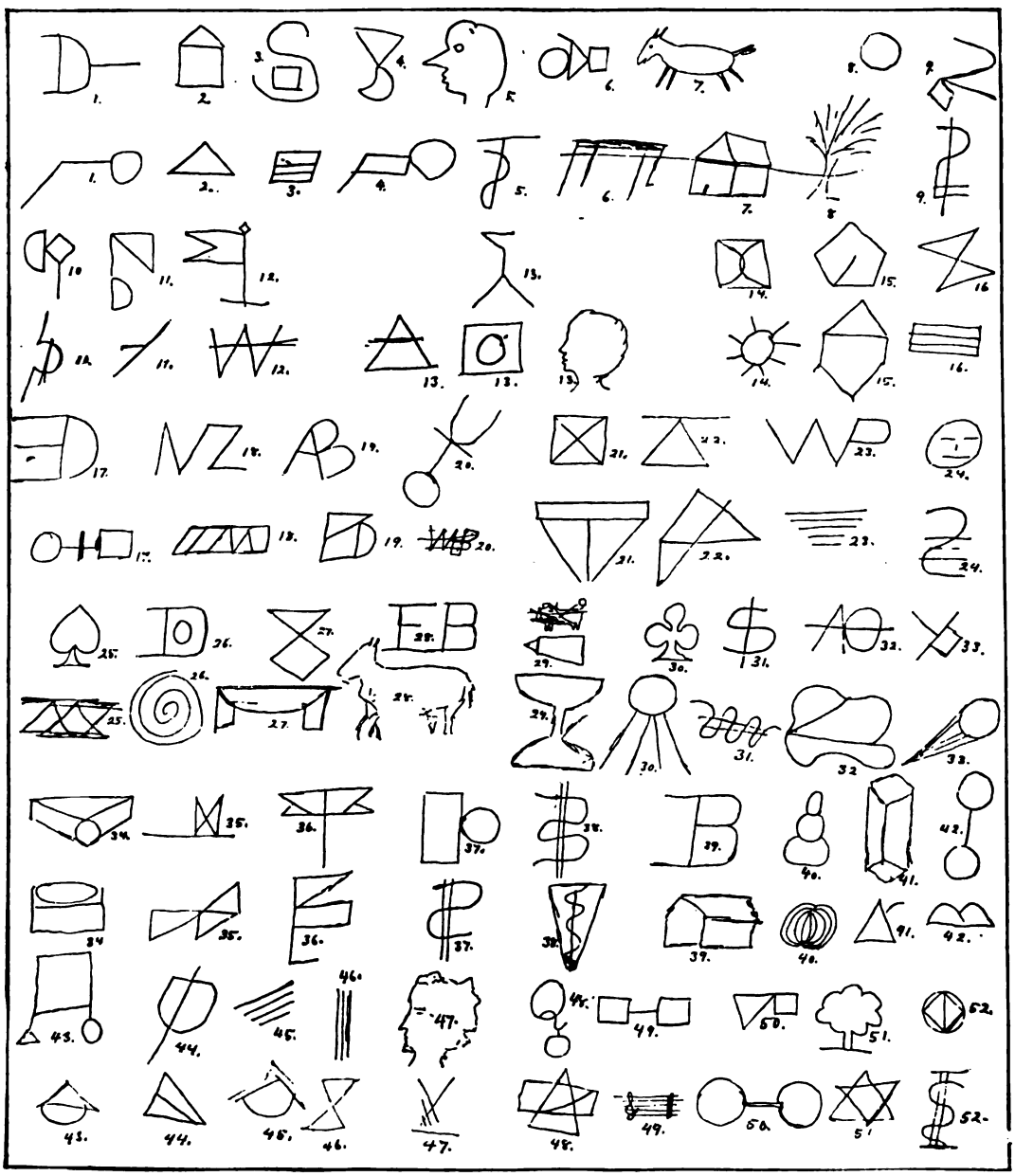
The yearly cost of repairing an overhead system, including roof-rentals, is not less than thirty per cent of the cost of construction; and the line would have to be renewed once in twelve years. The cost of repairing an underground system is practically *nil*. The Paris telephone company, with wires extending to three thousand subscribers, does not keep any repair-men. The durability of an underground system, provided lead-covered cables are used, and there is no internal cause of deterioration, is at least thirty years. Last summer we examined some lead-incased gutta-percha cables that had been in use by the French government for that length of time, and found them in perfectly good condition. The same is true of India-rubber cables incased in lead.

Herr Guillaume says of a cable in use by the German government, similar to the Faraday cable, "We are using it altogether in our new construction. I do not see how it can ever decay. We tried cotton-covered wires soaked in paraffine and drawn into lead pipes; and, though they worked well at first, after a few years they failed."

W. W. JACQUES, PH.D.,
Electrician of the American Bell telephone co.

THOUGHT-TRANSFERENCE IN BOSTON.

The committee on thought-transference, of the American society for psychical research, issued a circular during the winter, describing some simple experiments in guessing digits or the color of cards to test the theory of Professor Charles Richet of Paris, that thought-transference might exist to some degree in all persons. A large number of returns were received from persons making the trials according to the directions of the circular, and the results will



REDUCED FACSIMILE OF DRAWINGS SHOWING SOME EVIDENCE OF SO-CALLED THOUGHT-TRANSFERENCE.

be published in the first number of the proceedings of the society, which will appear during the summer. Besides these set experiments, Mr. W. H. Pickering of Boston met with some success in the experiments which have attracted so much attention from the English society, — experiments in which a drawing thought of by one person, is reproduced by another, who has no visible means of obtaining information as to what the drawing may be. In the accompanying illustration we have reproduced all the figures as they were drawn, numbering them from 1 to 52. The upper line in each case contains the originals, and the lower the reproductions. The originals were made either by Mr. Pickering or by one of his friends, and the reproductions were most of them made by a young lady, who, on one or two evenings when the experiments were tried, met with some success. It may be well to state, that with figs. 6, 7, 8, and 20, certain extraneous causes acted which interfered with the results. The first forty figures were all made in one day; figs. 41 to 47 inclusive were made by another person; the remaining figures were made by the sensitive, so called, on a day when apparently there was no thought-transference.

MIMICRY AMONG MARINE MOLLUSCA.

IT is a curious fact, that, while among the terrestrial animals the number of known cases of protective mimicry is very large, among aquatic animals it is very small. I have no doubt that the comparative poverty of our knowledge of the habits and situation of aquatic animals in part accounts for this, but I believe also that there is really vastly less mimicking. I do not know of any marine species, that, harmless in themselves, mimic formidable species for protection; but there are instances in which forms are modified in color or shape so as to resemble the surroundings in which they live, and thus escape the observation of their enemies. In the summer of 1879, Dr. E. B. Wilson, while studying in Brooks's laboratory at Beaufort, N.C., found abundant specimens of Ovulum uniplicatum, — a mollusk living upon the stems of Leptogorgia virgulata (a sea-fan abundant there in shallow sounds). The stem of the sea-fan is of an orange-yellow color, and, further, is often marked with yellow swellings where the coral has spread itself over the shell of an attached barnacle. The Ovulum has a yellow shell; and the skin folds up over the shell, and is also of an orange-yellow color, — precisely the same color as that of the pennatulid, — so that the snail escapes notice very readily indeed. It is abundantly found upon the Leptogorgia, and never met with except associated with it.[1] Last summer at Beaufort, in trawling in ten fathoms of water, a few miles off Cape Lookout, we took a Leptogorgia whose general habit was the same as that of L. virgulata, but which was very different from it in color. In this one the color is deep rose, almost purple, and mottled with white at the openings, where the polyps are fixed. Now, the question was, Is there an Ovulum for this Leptogorgia? and on examination, sure enough, there was found a large number of the Ovulums, in this case again imitating the colors of the host. This Ovulum is undoubtedly of the same species as the yellow one, for it presents no difference except in color. The shell is red-brown; and the folds of skin that surround it in the expanded snail are deep-rose color, and *mottled with white spots*. Here, then, is another very good illustration of the familiar principle that forms will vary in adaptation to their surroundings, and of the part that mimicry may play in natural selection. Confined in aquaria, the snails sought their own corals to creep over them; and, if the red snail and yellow coral only were put into the same aquarium, the snail showed not the least desire to creep over the coral, but remained creeping about the walls of the aquarium.

I observed another snail last summer that I feel sure must owe its shape and color, at least in part, to mimicry, though here there were not so good grounds for the conviction as in the case just mentioned. I found on the beach at Fort Macon, one day after a strong southerly gale, a single specimen of an undetermined species of Scyllaea, — a nudibranch characterized by a pair of tentacle shields, and two pairs of elongate narrow processes of the skin upon the back, on the inner side of which white delicate gills are placed. This creature, when placed upon the Sargassum, or gulf-weed, shows the closest resemblance to it. The color is almost identical with that of the alga, a light brown. The body is elongate and much compressed, and the foot-sole an elongate, narrow groove, perfectly adapted for adhering to the alga stem. The tentacle sheaths and the skin processes upon the back are thin, and at the edges are wavy, and present the most perfect resemblance to the leaves (?) of the alga. The compressed body is further terminated posteriorly by a thin vertical portion like a fin,

[1] Dr. W. Breitenbach, in *Popular science monthly*, January, 1885, p. 365, mentions vaguely some nudibranch that imitates the sea anemones upon the stems of Sargassum.

which is also thin and wavy-margined. Placed upon a mass of Sargassum in an aquarium, the Scyllaea was hard to find, so closely did it imitate the appearance of the leaves. To make this an undoubted case, the Scyllaea should have been found upon the gulf-weed, and should never occur anywhere else.[1] This was found on the sand; and it is the only specimen that has ever been found by our party, so that we may consider it a rarity. As it can swim very readily, almost like a heteropod in this respect, and is naturally found only in the outside waters, the chances were against their being found in any numbers. It seems to me that there can be but little doubt that this creature presents another interesting case of mimicry, and deserves mention, and additional observation if any one is so situated as to be able to make it. Henry Leslie Osborn.

PROFESSOR HUXLEY ON DARWIN.

Our readers have been informed, that, through popular international subscription, a fund had been raised to erect a statue to Charles Darwin, and that this was recently unveiled with appropriate ceremonies at the new museum of natural history in South Kensington. We copy from *Nature* the address upon that occasion, made by Professor Huxley in the name of the committee, to the Prince of Wales as representative of the trustees of the British museum. We accompany it by a portrait and signature of Darwin, taken from a photograph obtained in London in 1872, and inscribed, "I like this photograph better than any other which has ever been taken of me. — Ch. Darwin."

"Your royal highness, — It is now three years since the announcement of the death of our famous countryman, Charles Darwin, gave rise to a manifestation of public feeling, not only in these realms, but throughout the civilized world, which, if I mistake not, is without precedent in the modest annals of scientific biography.

"The causes of this deep and wide outburst of emotion are not far to seek. We had lost one of those rare ministers and interpreters of nature whose names mark epochs in the advance of natural knowledge; for, whatever be the ultimate verdict of posterity upon this or that opinion which Mr. Darwin has propounded, whatever adumbrations or anticipations of his doctrines may be found in the writings of his predecessors, the broad fact remains, that since the publication, and by reason of the publication, of the 'Origin of species,' the fundamental conceptions and the aims of the students of living nature have been completely changed. From that work has sprung a great renewal, a true *instauratio magna* of the zoölogical and botanical sciences.

"But the impulse thus given to scientific thought rapidly spread beyond the ordinarily recognized limits of biology. Psychology, ethics, cosmology, were stirred to their foundations; and the 'Origin of species' proved itself to be the fixed point which the general doctrine of evolution needed in order to move the world. 'Darwinism,' in one form or another, sometimes strangely distorted and mutilated, became an every-day topic of men's speech, the object of an abundance both of vituperation and of praise more often than of serious study.

"It is curious, now, to remember how largely, at first, the objectors predominated; but, considering the usual fate of new views, it is still more curious to consider for how short a time the phase of vehement opposition lasted. Before twenty years had passed, not only had the importance of Mr. Darwin's work been fully recognized, but the world had discerned the simple, earnest, generous character of the man, that shone through every page of his writings.

"I imagine that reflections such as these swept through the minds alike of loving friends and of honorable antagonists when Mr. Darwin died, and that they were at one in the desire to honor the memory of the man, who, without fear and without reproach, had successfully fought the hardest intellectual battle of these days.

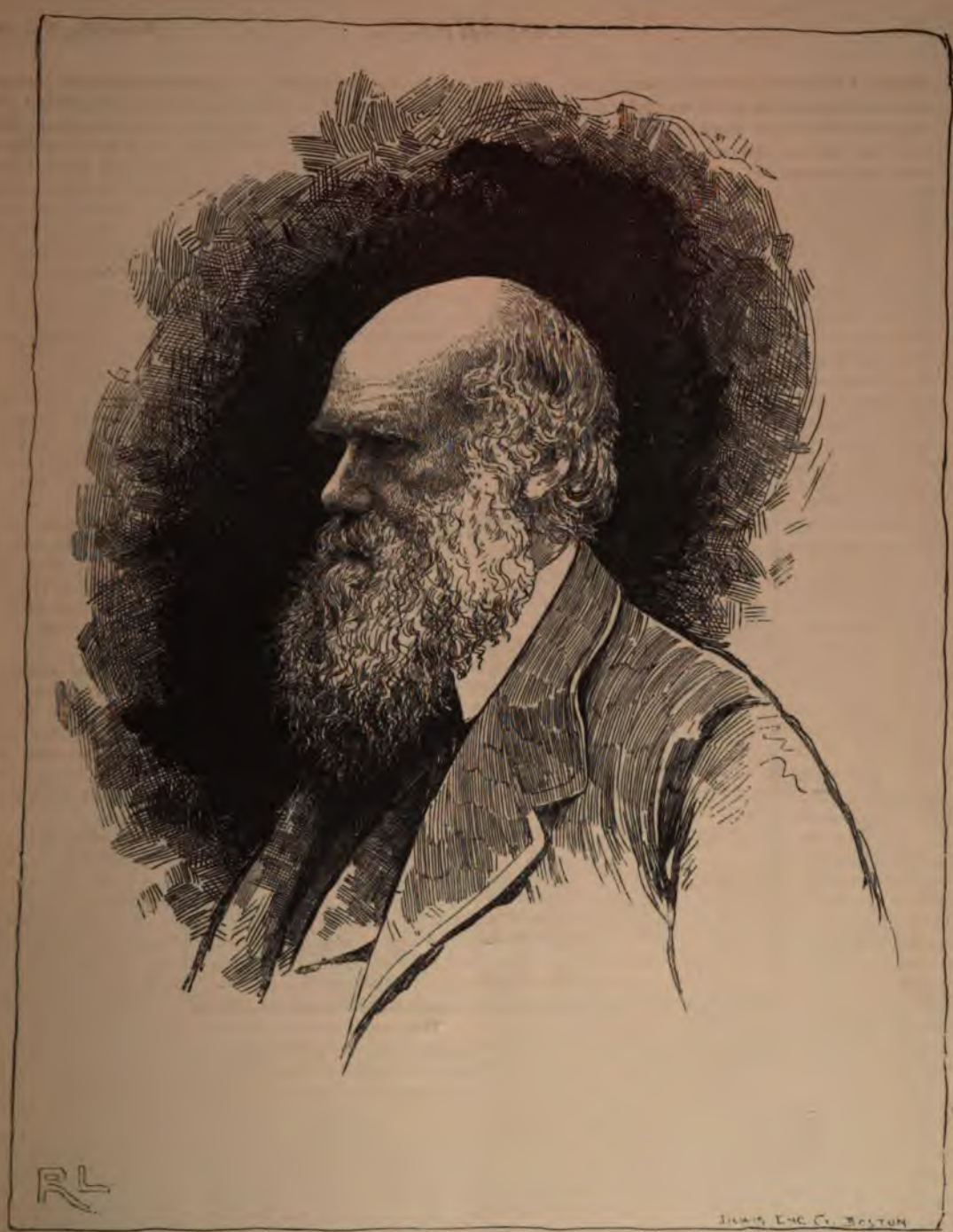
"It was in satisfaction of these just and generous impulses that our great naturalist's remains were deposited in Westminster Abbey; and that immediately afterwards, a public meeting, presided over by my lamented predecessor, Mr. Spottiswoode, was held in the rooms of the Royal society for the purpose of considering what further steps should be taken towards the same end.

"It was resolved to invite subscriptions, with the view of erecting a statue of Mr. Darwin in some suitable locality, and to devote any surplus to the advancement of the biological sciences. Contributions at once flowed in from Austria, Belgium, Brazil, Denmark, France, Germany, Holland, Italy, Norway, Portugal, Russia, Spain, Sweden, Switzerland, the United States, and the British Colonies, no less than from all parts of the three kingdoms; and they came from all classes of the community. To mention one interesting case, Sweden sent in 2,296 subscriptions 'from all sorts of people;' as the distinguished man of science who transmitted them wrote, 'from the bishop to the seamstress, and in sums from five pounds to twopence.'

"The executive committee has thus been enabled to carry out the objects proposed. A 'Darwin fund' has been created, which is to be held in trust by the Royal society, and is to be employed in the promotion of biological research. The execution of the statue was intrusted to Mr. Boehm; and I think that those who had the good fortune to know Mr. Darwin personally will admire the power of artistic divination which has enabled the sculptor to place before us so very characteristic a likeness of one whom he had not seen.

"It appeared to the committee, that, whether they

[1] Dr. Breitenbach, in the article above referred to, mentions without any names, and with too vague description for indentification, a creature on the Sargassum that would seem to be Scyllaea.



Ch. Darwin

From a photograph inscribed,
"I LIKE THIS PHOTOGRAPH VERY MUCH BETTER THAN ANY OTHER WHICH HAS BEEN TAKEN OF ME."

regarded Mr. Darwin's career or the requirements of a work of art, no site could be so appropriate as this great hall; and they applied to the trustees of the British museum for permission to erect it in its present position. That permission was most cordially granted, and I am desired to tender the best thanks of the committee to the trustees for their willingness to accede to our wishes. I also beg leave to offer the expression of our gratitude to your royal highness for kindly consenting to represent the trustees to-day.

"It only remains for me, your royal highness, my lords and gentlemen, trustees of the British museum, in the name of the Darwin memorial committee, to request you to accept this statue of Charles Darwin. We do not make this request for the mere sake of perpetuating a memory; for, so long as men occupy themselves with the pursuit of truth, the name of Darwin runs no more risk of oblivion than does that of Copernicus or that of Harvey.

"Nor, most assuredly, do we ask you to preserve the statue in its cynosural position in this entrance-hall of our National museum of natural history as evidence that Mr. Darwin's views have received your official sanction; for science does not recognize such sanctions, and commits suicide when it adopts a creed.

"No: we beg you to cherish this memorial as a symbol by which, as generation after generation of students of nature enter yonder door, they shall be reminded of the ideal according to which they must shape their lives, if they would turn to the best account the opportunities offered by the great institution under your charge."

ROUTES INTO THE INTERIOR OF WESTERN CHINA.[1]

A GLANCE at the map shows in Yun-Nan and the adjacent part of Burmah the proximity of several large rivers, which separate farther south, and empty along the coast between the Yellow Sea and the Bay of Bengal. Evidently the solution of the problem of reaching western China is to be sought in the course of these rivers or on their banks. The first of these rivers to the east is the Yang-Tze-Kiang, which may be easily ascended for seven hundred kilometres. Junks can proceed above that as far as Sion-Choo, in Se-Chuen; but it is impossible to go higher, and consequently impossible to reach Yun-Nan. South of the Yang-Tze-Kiang is the Si-Kiang, or Canton River, navigable to the city Pe-se, nine hundred kilometres. Regular caravans then proceed by land to Yun-Nan, a route which is shorter than by the Yang-Tze-Kiang. But Song-Ka, the river of Tonquin, offers a shorter route than this; and Lieut. Kergaradec says that steamers of light draught can reach Laos-Kai, on the Chinese frontier, while junks ascend to Mang-Hao, in the centre of the Yun-Nan territory.

We have nothing to hope from the Me-Kong. Its outlet is much farther away, and rapids are numerous. It is impossible at present to seriously think of building a railway on its banks a thousand kilometres in length, and, what is more, in an unknown, savage, and hostile country, and one of the most mountainous regions of the world. The Saluen empties into the Indian Ocean; but in most of its course it flows near the Me-Kong and Yang-Tze-Kiang, and traverses with them the province of Yun-Nan. Starting from Martaban, a stone road could proceed to the junction of the Main-Long-Gye, follow this river, traverse the mountain range which separates the basins of the Saluen and the Me-Nam, proceed to Zimme, then to Kiang-Hai, descend the He-Kok to the Me-Kong, and ascend this river to the frontier of China, and even as far as Talifu. This is a long and very hilly course; for it is necessary to pass from one basin into a second, then into a third, and, further, to build the route into the valley of the Me-Kong, — a plan any thing but practicable. It means gigantic labor and incalculable expense, without considering the probable hostility of the population.

[1] Condensed from *Science et nature*.

A railway already follows the lower course of the Irrawadi, between Rangoon and Prome. This route has just been extended to Tungu on the Sitang, and ultimately will proceed to Mandelay, and even to Bhamo. A branch could be made at Mandelay, and touch the Me-Kong at Kiang-Tung, though in this comparatively short space it must cross at least eight mountain chains having a height of two thousand metres. One can imagine the inclination of the sides and the depth of the valleys among mountains so near each other. The Saluen flows seven hundred metres below the hills which border it: it is therefore out of the question to consider this.

Another project is to start from Bhamo, and to reach Talifu by Man-Wyne or Momein. In this territory the hills are even more marked, more abrupt, and steeper, than in the preceding, and the population is much to be feared. Even the Brahmapootra has been suggested: it is easily ascended to Sooja, partly by rail, partly by steam; but above this the route is impracticable, there being a rapid and uninterrupted succession of high mountains and high-banked rivers.

To summarize these data, the two Chinese rivers must be abandoned, not precisely on account of the difficulties of the territory, but because for a long time the celestial empire will be more or less impenetrable and dangerous for Europeans, and the course of the Me-Kong is too long and too hilly. The routes which traverse the bed of the Brahmapootra and the valley of the Irrawadi present such obstacles that they are impracticable. The route of the Saluen is more attractive; but it must not be forgotten, that, besides its length, it must cross two watersheds, one of which at least is very difficult, and must ascend the Me-Kong for a very long distance. The route by the Red River remains, which is not at all wonderfully accessible; but, to establish communications with Yun-Nan and with Se-Chuen, some obstacles must be surmounted; and this is the course which offers fewest of them. Beside the fact that it is shortest, it will not be necessary to cross mountains or to traverse valleys. The French recently sent a commission of engineers to survey for a railway between Tonquin and Burmah. We doubt whether this project can be realized; but these investigations will necessarily bring forth important data in regard to the penetration of western China.

THE GEOLOGY OF JAPAN.

THE Japanese geological bureau has prepared a series of maps illustrative of the geology of the Japanese archipelago, to be presented at the Geological congress at Berlin this year. The bureau was established in 1879, and includes topographical, geological, and agronomical departments, and a chemical and technical laboratory officered by Germans. The area already surveyed by the topographers is about eighty geographical miles square; and the whole country is expected to be surveyed and mapped in about eight years more. The geological survey has reached about the same extent as the topographical. The maps and accompanying text are being published in both Japanese and English. The agronomical survey was begun in 1882. A map showing the knowledge at present attained, of the geological structure of Japan, is amongst the series. The observations made are summarized as follows: All the geological formations are met with in Japan. Gneiss occurs in small quantities in the neighborhood of Nagasaki and in the centre of the main island. Crystalline schists, consisting of mica, talc, marble, serpentine, etc., are found in Shikoku and the south-west of the main island. The paleozoic formations embrace the largest portion of the country, and are found everywhere. The mesozoic formation, including trias, jura, and chalk, is also known in Japan, but is not so prevalent as the previous one. Trias occurs in the north and south-west of the main island and in Shikoku. Chalk is found widely distributed in Yezo, the main island, and Shikoku. The cenozonic formation, including the tertiary and quaternary, is found everywhere on the edges of the older mountain ranges. In these formations numerous remains of mammals are found, especially of prehistoric elephants. Of the Plutonic rocks, granite is found widely distributed, and covers, next to the paleozoic formations, the widest area. The volcanic rocks consist mostly of trachyte and andesite: basalt is rare. Among the soils in Japan is the so-called tuff, i.e., volcanic tuff, which, for the most part, consists of decomposed silicates, and which is of great importance to agriculture. It is almost wholly unknown in Europe, while in Japan it forms the greater part of the so-called *hara*, which are the uncultivated plains at the foot of mountains, but which will bear cultivation. Accurate knowledge of this kind of soil will be of the utmost moment to Japanese agriculture. It is also noticeable that Japanese soils in general are very poor in chalk, and would therefore be improved by the addition of marl and chalk.

AMERICAN ENGINEERS AT DEER PARK.

THE annual convention of the American society of civil engineers, just held at Deer Park, Md., June 24–26, will be remembered as one at which more business was transacted, and more discussion elicited, than at any previous convention of the society. In fact, the limit in this direction may fairly be said to have been reached; and the thin attendance at the meetings of the last day was followed early in the afternoon by a motion, which was unanimously carried, that the reading of the remaining papers be dispensed with, as the members were too tired to listen to them. The experience at the conventions of the past few years had indicated the advisability of devoting less time than formerly to excursions and sight-seeing; and the meeting this year was therefore purposely held in a place offering little of local engineering interest, and where almost the whole time could be devoted to the business of the occasion.

The convention was attended by over one hundred

members; and the proceedings were opened on Tuesday, June 23, by the reading of a very interesting paper by Mr. E. B. Dorsey, entitled 'English and American railroads compared.' It appears that the average cost of the English railroads has been $202,227 per mile, as against $62,176 for the American roads. At six per cent, to justify this increased expenditure, that part of the operating expenses which is affected by good or bad construction should involve a saving of about $8,000 per mile per year in the case of the English roads. The comparisons of the writer showed that this was by no means the case, the saving being rarely over $1,000. Comparisons of this kind, however, cannot pretend to be more than approximations, as the items of expense cannot always be accurately separated; and, moreover, the figured cost of English roads probably includes the cost of parliamentary proceedings in obtaining the charter. Regarding the physical characteristics of the English roads, few of them attain elevations of nine hundred feet above the sea; and their construction, therefore, offered few engineering difficulties, their greater first cost having been due to the almost entire absence of temporary structures. Recently several miles had been laid with steel sleepers, weighing a hundred and twenty-four pounds, on the London and north-western railway, following the example of the German roads, where they are quite common. Of freight-cars, only about twenty per cent have brakes in England; and these are so placed that they cannot be operated when the train is in motion: so the only effective ones are those on the engine and caboose. And in passenger-trains, where the air-brakes are used, but where only one car in three or four has a hand-brake, platform-cars heavily loaded with cast-iron, and provided with powerful hand-brakes, are attached on steep grades, to hold the train in case of accident to the air-brakes.

Prof. T. Egleston of New York presented an interesting paper on the cause and prevention of the decay of building-stones. In the speaker's investigation of the decomposition of calcareous materials due to the action of city gases and rain-water, he had found that the action was a maximum at a height of ten feet above the ground, above which point it decreased, and was null above a height of a hundred feet. To prevent decay, the only remedy was to make the stone water-proof. The speaker believed that a wash of sulphur was the only thing of value, where the stone was a dolomite, according to some experience in England. In the case of all porous stones, he considered that an effectual remedy would be to immerse the stone in boiled linseed-oil, renewing the application until the stone was saturated. Some discussion on this paper took place, many members believing that the use of oil would prevent the formation of a good bond between the stones and the mortar. It was stated, however, that the method had been tried with success in England.

A valuable and extensive report was presented by the committee on the preservation of timber, whose work has covered five years. It appears from the experience in this country that Kyannizing, or treatment with corrosive sublimate, though of value when the wood is only exposed to occasional moisture, is not efficacious when the wood is permanently wet. Although the testimony obtained was somewhat conflicting, the committee recommended the process of Burnettizing (chloride of zinc) as the best process for preserving railroad ties, principally on account of the low cost, which was only from twenty to twenty-five cents a tie. Creosoting was found too expensive; although it is the only effectual method for wood exposed to the attacks of the teredo and limnoria, and is, without doubt, the most generally successful process. In connection with this report, a report was presented by Mr. F. Collingwood, on the preservation of forests.

A paper followed by Mr. Jos. M. Wilson of Philadelphia, on specifications for iron and steel railroad-bridges, which was succeeded by a long discussion regarding the cantilever bridge at Niagara Falls, on which a paper had previously been presented to the society. The specifications for this bridge, in which steel was used for all the principal compression members, provided for the use of open-hearth steel alone. In this discussion the opinion was very generally expressed that Bessemer steel should not have been barred out, and that in drawing up specifications the engineer should insist simply on a certain quality as determined by physical tests, leaving the manufacturer free in the method of manufacture. It is probable in this case, however, that Bessemer steel was excluded to prevent delays in getting steel from works that had not had experience in making steel for structural purposes, as most of the Bessemer works had been making rail steel, and not structural steel. The fact that in making the steel for this bridge a hundred and thirty-six beats out of two hundred and forty-five were rejected, showed, in the opinion of many members, that engineers were requiring too much of steel, that the specifications were too rigid, and that a softer steel should have been used.

Among the remaining papers presented, brief mention may be made of a few. Mr. J. A. Ockerson described a new apparatus for printing conventional topographical signs upon maps by means of a roller. Mr. Clemens Herschel gave a new method of determining the discharge over a submerged weir. Capt. Michaelis read a paper entitled 'Can we make heavy guns?' Professor Egleston added his testimony that there would be no difficulty in making cast-steel guns of a hundred or even a hundred and fifty tons. Mr. C. B. Brush explained the method of aerating the water supplied to Hoboken. The bad taste and disagreeable odor previously existing had been entirely remedied.

In addition to the reading of papers, some important business was transacted at the convention. There having been considerable discussion of late in regard to the proper relation to each other of the form of the head of a rail, and the flange, and tread of wheels, it was resolved that a committee of five be appointed to investigate this subject. It was also resolved to memorialize congress to appropriate the sum of ten thousand dollars to carry on tests of steel

for structural purposes, under direction of this society, at the Watertown arsenal. The most important action, however, was the passage of a resolution providing for the appointment of a committee of seven, to consider what changes in the organization of this society might be advisable in connection with local engineering societies, and with sections or chapters of this society.

WORK OF THE CHALLENGER EXPEDITION. — I. GENERAL AND PHYSICAL.

Two immense quarto volumes luxuriously printed, and crowded with maps, plates, and woodcuts, form vol. i. of the series of Challenger reports, and the official introduction to that series when it shall be complete. This publication, unlike the monographs of which the series is composed, is the work of many hands, and has been editorially supervised by Staff-commander Tizard, R.N., Prof. H. N. Moseley, Mr. J. Y. Buchanan, and Mr. John Murray.

Owing to the recall of Capt. Nares for duty with the last British arctic expedition, the death of Sir Wyville Thomson, and other unforeseen occurrences, modifications of the original plan became necessary. The result is not altogether satisfactory to the editors, as they explain in the preface. It may be surmised that official red tape had something to do with the retention of a system, or rather want of system, which certainly might have been much improved; though, for that, the gentlemen named would appear not to be responsible. Thus, instead of finding the contributions of the expedition to any one branch of science summarized, or systematically and continuously indicated, the text abruptly changes, without apparent reason, from (let us say) hydrography to narrative, or to some abstract of new organic forms in a particular group, which seldom seems connected in any intimate way with the locality being described or with the subsequent text. Occasionally we get a section of transcendental theorizing on abstruse questions, of a sort which, however proper in its place, seems to us out of place in a volume intended for the general reader. The editors were also hampered by the fact that many of the special reports were incomplete, or not in a state to be briefly summarized. The inconveniences of the construction of the book will be sufficiently obvious to every reader; but, having said this, little more remains in the way of adverse comment. That the work is a mine of wealth for the hydrographer, the biologist, and the geographer, goes without saying. Even the ethnologist will find himself well rewarded for his study of its pages. The illustrations, though of unequal merit, are, for the most part, of a high degree of excellence; and some of the woodcuts, especially of corals, are extremely beautiful. Much of the success in this direction is doubtless due to the efforts of the artist of the expedition, Dr. J. J. Wild. There is a notable absence of the cheap 'process' cuts so conspicuous in most of our own government publications.

It is of course impossible, within the limits of *Science*, to adequately review a work of twelve hundred quarto pages, which in itself is a summary and a synopsis. We shall endeavor to touch upon a few of its more prominent features, premising that our references must necessarily be mere samples of the harvest gathered in its pages.

The voyage of the Challenger began, for deep-sea work, off the coast of Spain; thence, *via* the Canaries, across the Atlantic to the West Indies at St. Thomas; northward in a nearly direct line to Halifax, *via* Bermuda; southward along the coast to a point off the capes of Delaware to Bermuda, and again across the ocean to Madeira; southward again along the African coast nearly to the equator; westward to St. Paul Rocks and Cape Roque; south and south-east to latitude 40° south; eastward to Tristran da Cunha, the Cape of Good Hope, Marion, the Crozets, Kerguelen, and Heard Island; south to the antarctic ice; north-east to Melbourne and New Zealand; northward to Tongatabu; and westward through the Coral Sea and through the Philippine archipelago, and to Hong Kong. Thence they retraced their way, and, passing north from Papua to Anchorite Island, made a straight wake for Japan; and then eastward across the Pacific to the meridian of 156° west; southward to the Hawaiian Islands, Tahiti, and south latitude 40°; thence eastward to Juan Fernandez and Valparaiso; south, and through Magellan Straits, to the Falklands; and across the Atlantic to the 13th westerly meridian, near which they struck northward to the Cape Verdes, and so home. This course, it will be observed, gave, in the Atlantic, practically four transverse and two axial sections, a complete though rather irregular belt about the southern hemisphere, and an immense rectangle in the Pacific. The opportunities of such a navigation may be better imagined than described; and that they were not neglected, the magnifi-

Report on the scientific results of the voyage of H. M. S. Challenger [etc.]. Narrative. 1 vol. in two parts. London, *Government*, 1885. 4°.

cent work before us, with its companion volumes, is satisfactory testimony.

As is natural, the introductory chapters have something of an historical nature, apart from the narrative of the voyage itself; and the progress of deep-sea research is summarized, though without pretensions to monographic completeness. The remarkable results obtained by Sir John Ross, and his foreshadowing of many modern methods, are deservedly praised; and there is no doubt he was half a century beyond his contemporaries and many of his successors. The vessel, her fittings, and the methods of observation adopted, the instrumental devices provided for the regular work, and those suggested by experience, are described and figured in detail. It is known that the work of the Challenger was done with hempen lines, — the method in common use at the time she went to sea, — though wire was adopted shortly afterward. Bearing this in mind, it is easy to note a touch of official conservatism in the statement (p. 71), that "for purposes of deep-sea investigation, however, which includes actual sounding as only one of its items, good hemp sounding-line is still indispensable." The errors inevitable to the use of hemp, in all water not absolutely motionless from top to bottom, are sufficient to decide in favor of its rejection. These errors in the case of the Challenger sounding-work off the coast of the United States, where tested by the U. S. navy, are believed in some instances to reach more than two hundred fathoms, and are always liable to be as great when hemp is used. This is no reflection upon their work, which was unquestionably as good as their outfit permitted; but it forms an irrefragable argument against the use of rope, when a more accurate method is available.

Without attempting to go into detail for particular localities, it is worth while to trace the general physical features of the sea-bed, as developed by the Challenger work, and enlarged and confirmed by other expeditions, as represented by the charts accompanying this volume. These would have been still better, had the localities of supplementary information been indicated; for the hypothetical part, necessarily large, would thus have been much diminished for the casual inspector. It is pretty well determined, however, that the Atlantic is divided by submarine ridges into three different basins. These ridges, and the deeps they separate, are of singular conformation. From the southern part of Africa a ridge extends southwesterly to mid-ocean. From this a ridge extends a short distance westward, and another nearly due north to the equator. Sheering off from the African coast, with which it nevertheless preserves a curious parallelism, it extends north-westward, throwing off a spur toward French Guiana, which closes the northern rim of the south-western Atlantic basin. The central deep of this basin is supposed to lie about seven hundred miles off the mountainous coast-region of Brazil, from Cape Roque to the Rio Doce. From the last-mentioned portion of the ridge, it extends northward and eastward, widening as it goes, rising above the sea at the Azores, and finally joining the great arctic plateau, nearly in mid-ocean, at about the latitude of Paris. The north-western basin has its greatest deep north from, but close to, the Windward Islands. Here the coast-survey has since found the deepest water known in the North Atlantic. The eastern basin, of irregular and elongated form, has two deeps, — one westward from the Cape Verde Islands, the other north-eastward from St. Helena. There is a smaller depression just south from Cape Palmas.

In the southern ocean the antarctic plateau extends nearly to Africa, in latitude 40° south, and reaches New Zealand and Patagonia by narrow isthmuses. The vast area of the Pacific is less known and less markedly divided. Its greatest deep lies along the Kurile Islands, is very narrow, and is doubtless the deepest depression existing in any ocean. Apart from the Polynesian area, its most conspicuous elevation extends sickle-shaped from the coast of South America in latitude 40° south, to the meridian of 120° west. Otherwise the eastern portion of the Pacific presents an astonishing uniformity.

JAGNAUX'S TRAITÉ DE MINÉRALOGIE.

It would not seem to be an unreasonable demand, that a volume of nine hundred pages, and bearing the date of 1885, should contain enough fresh and valuable matter to make its study thoroughly profitable to those specially interested in the subject of which it treats; but this will hardly be found to be true with this new Mineralogy of Jagnaux. The reader who expects to find the value of this large volume in proportion to its size will be much disappointed. The task which the author has set for himself — that is, the preparation of a work which shall give scientific descriptions of all important mineral species, and at the same time develop all the applications of

Traité de minéralogie appliquée aux arts, à l'industrie, au commerce et à l'agriculture, etc. Par Raoul Jagnaux. **Paris**, *Doin*, 1885. 883 p., 468 figs. 8°.

mineralogy to the various arts — is not an easy one. The two branches of the subject are too distinct to be easily fused together. The methods of crystallography and the process of making bricks are not very closely related. About one-half of the volume is devoted to the preliminary discussion of the general characters of minerals, physical and chemical, and to the description of species. This portion of the work is not only in no sense an original contribution, but it is not even a satisfactorily competent presentation of the present condition of the science. The author is evidently a faithful student of Haüy and Dufrénoy, but hardly seems to be aware of any thing that has been done, even in his own country, in the last twenty-five or thirty years. The chapters on crystallography and the optical characters of minerals, the classification and description of species, are all consistent in being what Dufrénoy would have given us in 1856. Even in minor points, modern innovations have been resisted: silica still appears in all the formulas as SiO_3, water as HO; and so on.

The portion of the work which is devoted to the practical side of the subject contains, however, much that is interesting and valuable, if not always original. In the preparation of it the author states that he has visited personally many manufactories and technical works, as well as consulted numerous standard books upon the subject. Some of the topics discussed in greatest detail are the coal industry, the manufacture of glass, of powder, of bricks, of porcelain, the treatment of various ores, and so on. The descriptions here are minute rather than profound, many trivial points receiving more attention than they deserve. The frequent long quotations from other authors, too, give the whole treatment rather a patchwork character. The reader looks in vain in this part of the work, as in the other, for evidence that the author is thoroughly acquainted with the progress that recent years have brought, especially outside of his own country. However, it must be allowed that a large amount of interesting matter has been brought together, particularly in regard to some of the leading French industries; and for this the book should have all the credit that it deserves. That the author had only a French audience in mind, is shown by the fact that the bibliography at the close of the volume contains (with the exception of two translations) only titles of French works; but while no fault need necessarily be found with this, we can but regret that he has not made more use of such admirable works as those of Des Cloizeaux and Mallard, which are mentioned in his list.

GEOLOGY OF THE VIRGINIAS.

IN publishing this compilation of Professor Rogers's contributions to the geology of the Virginias, Mrs. Rogers has conferred a substantial benefit upon the science; for Professor Rogers's investigations still remain the most important and the only systematic or comprehensive attempt to elucidate the geology of these great states, which are not excelled in structural complexity, or the interest of the problems which they present, by any district in eastern North America. But his reports were printed from forty to fifty years ago; and copies of them are now so extremely rare, that many geologists of the present generation have probably not seen them, and are not aware of the vast amount of careful and enduring work which they represent. Hence this reprint is in many respects as fresh and timely as the original publications, with the great advantage of combining in one convenient volume all of the annual reports and the widely scattered separate papers, and thus forming a handbook of Virginian geology which will be indispensable to the student of the Appalachian system, and constitute a necessary starting-point for all future investigations in the Old Dominion.

The geological survey of Virginia was instituted in 1835, and Professor Rogers's annual reports to the legislature for the first seven years make up the principal part of this volume. These reports were very properly designed for popular instruction, and are models of clearness and simplicity of style, without evident sacrifice of scientific accuracy and detail; while the general absence, in both terminology and theory, of indications that they were written nearly half a century ago, is a matter of constant surprise.

The difficulties attending geological explorations in Virginia were much greater at that time than now; but Professor Rogers's energy and industry had brought the survey of the largest area ever at that time subjected to systematic geological examination within one year of completion, according to his original plan, when it was abruptly terminated by the failure of the legislature to continue the appropriation. No provision was made for the final report, which was to embody in a digest-

A reprint of geological reports and other papers on the geology of the Virginias. By the late WILLIAM B. ROGERS, LL.D., etc. New York, *Appleton*, 1884.

ed form every important result attained in the progress of the survey, including the illustrative maps and sections. It is more pleasant than properly characterizing this short-sighted policy of the state, to call attention at this late day to the fact that this reprint of the annual reports is accompanied by a very satisfactory geological map of the Virginias, colored by Professor Rogers; by a generalized section from Chesapeake Bay to the Ohio River; and by ninety-six more local and detailed sections, traversing nearly every part of the two states, but especially the great valley and the neighboring mountain ranges. The sections are colored, and are exact reproductions of the originals drawn by the author. They are indicated on the map by lines numbered to correspond with the plates.

The arrangement of the book is chronological; and the annual reports are followed by several papers, published between 1840 and 1842, on the thermal springs of Virginia, illustrated by a plate of sections.

The often quoted paper on the physical structure of the Appalachian chain, by Profs. William B. and Henry D. Rogers, with three plates, dates from the same period, and must be regarded not only as an admirable summary of the characteristics of the Appalachian system, but also as an important chapter in the history of geological theories. This is followed by the evidence supporting Professor Rogers's view that the coal-bearing rocks of eastern Virginia are Jurassic, with a plate of coal-plants; and a discussion of the divisions of the tertiary, with five plates of eocene and miocene shells.

The volume concludes with an account of the infusorial deposit of Virginia, as exposed in the Fort Monroe artesian well, five hundred and fifty-eight feet below the surface. This was published in 1882, and, in the language of the editor, has a special interest, not only as the last published investigation made by Professor Rogers, but as being in the *same* field in which he began his labors half a century before.

The volume is provided with a good general index, and a full index of persons and places; and it is so conveniently compact, that the magnitude of the work is not realized until one attempts to read it.

NOTES AND NEWS.

The statue in marble erected to the memory of Charles Darwin, executed by Mr. Boehm for the subscribers to the Darwin memorial, has been placed in the great hall of the new building at South Kensington containing the natural-history collections of the British museum. It is conspicuously placed at the head of the first flight of the great staircase, "as though," says the *Times*, "to welcome all coming generations of students as they enter the door of the building in which so many of the materials of their work are gathered together. So far as was possible, Mr. Boehm has rendered the very features and character of his subject; and all Mr. Darwin's friends agree, that a likeness more characteristic, whether in face or attitude, could hardly have been produced, even by a sculptor who had been intimately acquainted with him in his lifetime. The head is full of dignity: the great brow, the flowing beard, the expression, full at once of intense thought and of human feeling, have been caught and fixed in the marble." We have given elsewhere the address of Professor Huxley on the occasion.

— Among recent appointments at Harvard college, we note that of Winfield Scott Chaplin as professor of engineering; William Morris Davis, assistant professor of physical geography for five years; and Dr. Harold C. Ernst, demonstrator of bacteriology for 1885–86. The degree of LL.D. was conferred on Alexander Agassiz the naturalist, and Benjamin Apthorp Gould the astronomer.

— We learn from *Nature*, that on the receipt of communications concerning the proposed change in the time for beginning the astronomical day, as recommended by the recent International meridian conference at Washington, the lords of the committee of council on education requested the following committee to advise them as to what steps should be taken in the matter: Prof. J. C. Adams, the astronomer royal; Capt. Sir F. Evans, the hydrographer of the navy; Gen. Strachey; Dr. Hind; and Col. Donnelly. In accordance with their recommendations, copies of the report of the delegates to the conference at Washington, together with the resolutions adopted by that body, have been sent to various departments of the state, and to the following societies, etc.: Society of telegraphic engineers, Royal astronomical society, Royal society, Submarine telegraph company, Eastern telegraph company, Eastern and South-African telegraph company, Eastern extension, Australasia and China telegraph company, and the Railway clearing-house. They have been informed that these resolutions of the conference appear to my lords of the committee of council to be such as commend themselves for adoption; but, before informing the American government to that effect, their lordships would be glad to receive the opinion of the various societies on the subject.

— The last annual report of the Russian geographical society contains extracts from letters addressed by Prjevalski to the Grand Duke Alexander Alexandrovitch, which contains some further interesting details about his Hoang-ho journey. About the end of May he reached, as known, the foot of the Burkhan-budda Mountains, which enclose the high Thibet plateau separating it from Tsaidam.

Leaving there his baggage, he went with only thirteen men to the sources of the Yellow River. The climbing on the 15,700-feet-high passage of the Burkhan-budda ridge took three days. The descent, on the contrary, was very short, the plateau of Thibet being there 14,000 to 15,000 feet high. Further, 60 miles across the desert plateau brought the traveller to the sources of the Yellow River. They are 13,600 feet above the sea-level, and consist of two rivers coming from the south and west, and rising in the hills scattered on the plateau. A wide marshy valley, Odon-tala, 40 miles long and 20 miles wide, feeds numerous springs. The Hoang-ho itself is only a rivulet, dividing into two or three branches, each of them but 80 to 100 feet wide, and only 2 feet deep at low water. Some 13 miles below this place the Hoang-ho enters a broad lake, coloring its southern part with its muddy water; and, after leaving it on the east, it enters again another lake, whence it flows out as a large river; farther down it makes a great curve to avoid the snow-covered Amis-matchin range, and breaks through, in a wild course, the parallel ridges of the Xuen-lun. On the Thibet plateau the expedition experienced dreadful cold. In the second half of May, snow-storms were as strong as in winter, and the night frosts reached —23° C. Still the thin grass covering did not perish, and a few flowers re-appeared every day under the sun's rays. Even in June and July the thermometer fell, during bright nights, as low as —5°. As to rain, it poured every day, sometimes several days without interruption. The amount of vapor brought by the south-west monsoon, and deposited there, is so great, that during the summer northern Thibet becomes an immense marsh; needless to say, that the advance was difficult for camels. Though uninhabited by man, these deserts were full of herds of yakes, khoulans, antelopes, and mountain sheep. Even bears were seen in groups, sometimes of more than ten at once. Some thirty pairs were shot down. They are altogether very cowardly, and fly even when wounded. After having spent a few days at the source of the Hoang-ho, Prjevalski went south to the Blue River, called there Dy-tchou by the Tangoutes.

— Dr. Stephen Bowers, who is well known to archeologists from his extensive collecting in California, has recently described in the Ventura *Free press* an interesting discovery made by him in a dry cave in the San Martin Mountains, Los Angeles county. The cave was about twelve feet by sixteen. In it were nine baskets from six to twenty inches in diameter, made from tule, one of which contained fourteen pieces of red wood about a foot ong, notched, and painted with red and blue in streaks. Some of these sticks had as many as one hundred notches, and each stick was perforated at the ends. Another basket contained thirty-three head-dresses from four to five feet in length, made of feathers; another, forty-five whistles made from the tibiae of deer, the 'stop' being formed by inserting a mass of asphaltum, and the larger end of the bone covered with asphaltum in which is embedded a piece of haliotis shell. The most important objects found were four perforated stones mounted on handles of the hard wood of the bearberry, held fast in the holes by asphaltum. The discovery of these perforated stones, with short handles attached, is an important confirmation of F. W. Putnam's conclusions in relation to the probable use of the majority of similar stones, of which hundreds have been found in graves in southern California. The cave gave no evidence of having been used for any other purpose than as the place of deposit of these articles. Considerable basket-work was discovered in the *débris*, as also a haliotis shell-cup, a shell ornament, an implement made of deer's antler, and a smoothing-implement made of serpentine. No determination could be arrived at as to the length of time the articles had been in the cave; but, as it was perfectly dry, they may have been there for centuries.

— *Nature* gives the results of some recent experiments by Fol et Sarasin on the depth to which the light of the sun will penetrate into the sea. It will be remembered that in November last they recounted the results of their experiments on the same subject in the Lake of Geneva. The present paper describes similar experiments made in the Mediterranean off the zoölogical station and harbor of Villefranche. By means of photographic plates they have proved, that in the month of March, in the middle of a sunny day, the rays of the sun do not penetrate beyond four hundred metres below the surface of the Mediterranean. This is established by seven separate experiments, at varying depths, and different hours of the morning. At 380 metres, shortly before 11 A.M., the impression on the plate was less than that which would have been left on exposure to the air on a clear night without a moon. Between 1.20 and 1.30 P.M., at a depth of from 405 to 420 metres, there was no trace of any impression whatever on the plate. Light clouds do not appear to cause any notable diminution in the depth to which the light penetrates. In the Lake of Geneva the writers also undertook a new series of investigations to determine the effect of the season on the penetration of light. They give 200 metres as the extreme limit for winter in the lake; but they found that there is as much light at 380 metres in the Mediterranean as at 192 metres in the Lake of Geneva; and, by a comparison of these with previous experiments, it appears, the light penetrates from twenty to thirty metres deeper in March than in September: in the month of August, perhaps the difference is a little more. Compared with the series of plates exposed in the lake, those of the Mediterranean are characterized by a slower and more regular gradation. This gives rise to the idea, that while in the lake the light would be promptly intercepted by the deeper layers more or less disturbed or muddy, in the Mediterranean the absorption proper to pure water would be the principal, if not the sole, factor in arresting the luminous rays.

— One of the questions for discussion at the Sanitary congress at Rome was the measures to be adopted in regard to vessels from the east when they arrive in Mediterranean ports. Dr. Proust, the French

delegate, proposed "that vessels which had cases of cholera on board should be subjected to seven days' isolation, and that all the people on board should be divided off into groups, each of which should be released separately, if, after five days' observation, no case of cholera should have appeared among the persons composing such a group."

— The U. S. entomologist informs us that the destructive locust of California this year, as appears from larvae recently received, is Melanoplus devastator. Caloptenus differentialis has also been sent, but the former must be the chief source of injury.

— The Meteorological society of Vienna has resolved, says *Nature*, to erect a meteorological station on Mount Sonnenblick, near Tauern, in the central range of the Tyrolese Alps, thirty-one hundred metres above sea-level, and thus the highest station of the kind in Europe.

— The *Geological magazine* of London attains its majority the present summer; and as the present editor, Dr. Henry Woodward of the British museum, has been connected with it from the beginning, and during almost the whole time as its editor in chief, his friends are proposing to present him with a testimonial for the ability and fairness with which this successful magazine has been conducted. Friends of Dr. Woodward and of the magazine can forward any subscriptions to the treasurer, Mr. G. J. Hinde, 11 Glebe Villas, Mitcham, Surrey.

— One 'Prof. A. H. Lockwood,' *alias* 'Rev. J. H. Rockwell,' was arrested on June 17, at Garden Grove, Io., charged with using the U. S. mails for conducting fraudulent operations in the purchase and sale of scientific books. Any of our subscribers who have been defrauded will do well to communicate with D. H. Pulcifer, post-office inspector at Des Moines, Io.

— We learn from *Nature* that important experiments in aerial navigation are now being made by Mr. A. F. Gower, well known in connection with the Gower-Bell telephone. The operations being carried on are more particularly directed towards the adaptation of balloons to war purposes. On May 31, the wind being favorable, one of the automatic pilot balloons invented by Mr. Gower, with appliances for giving out its own gas and ballast, one compensating for the loss of the other, was filled with twenty-three hundred feet of gas, and ascended at about 11 o'clock. In the car a written statement was of course placed, explaining the ownership of the machine and its object, with the result that it was next heard of at Dieppe, having made a rapid passage of about seventy-two miles in a straight direction, and descended at 2.30 in the afternoon. On June 1 another pilot balloon, with a capacity of forty-three hundred feet, was started, and immediately followed by Mr. Gower in his own balloon (containing twenty-three thousand feet of gas). The object of Mr. Gower in ascending was to watch the action of the pilot; but the smaller machine made such rapid progress, that it got out of his observation, and came down in the vicinity of Paris. Meanwhile, Mr. Gower, who ascended about noon, reached the French coast at Boulogne and then, taking a northerly curve, travelled o to Calais, where he made a smooth descent a

— Among recent deaths we note the followin fessor Dunkes of Marburg, a well-known mine and paleontologist; Samuel Cabot, ornitholc Boston (the type specimens of his collection to the Boston society of natural history); F Weyenbergh, professor of zoölogy at the Univ Cordoba, during a visit to his home in Holla Fred. Gustave Henle, physiologist and anato Berlin, May 18, in his seventy-sixth year; D ard Böhm of Berlin, African explorer, in his second year; Dr. Carl Ohrtmann, mathemati Berlin, April 22; T. R. Peale, entomologist, adelphia, March 13; C. Cornelius, entomolo Elberfeld, April 1, in his eightieth year; J. P. sen, at Thisthdt, Jutland, April 30; Prof. Panum, physiologist, at Copenhagen, May 1, sixty-sixth year; Paul Desains, physicist, at May 3; Dr. K. J. Andrae, professor of min and paleontology at the University of Bonn, at May 8; Mr. William Ladd, the well-known sc instrument-maker, in his seventy-first year; von Schlagintweit, professor of geography a nology at the University of Giessen, in his fift year.

— Dr. Herman Koch, the bacteriologist, ha created professor in the University of Berlin.

— Last year was a tolerably productive one collectors of prehistoric remains in Switz The water of the lakes was almost constantly the highest level, which is the most favorab of things for explorations around the lake-dw The remains discovered belong mostly to the period; and the chief localities in which the found were Lake Neuchâtel, and the settlem Walleshofen near Zurich, the latter of which only station of the bronze period yet known i ern Switzerland. Amongst the most rema articles discovered at this settlement in 1884 splendidly preserved bronze sword, several do bronze hatchets, bracelets, etc. Of the rem the stone period discovered in the same ye most notable are those obtained at Robenhaus cluding several pretty knife-handles made of some excellent specimens of mechanical in such as thread, woven fabrics, fishing-nets, etc ears of barley and wheat, one being a specimen rare Triticum turgidum.

— The sultan of Zanzibar claims the whole from Cape Delgado to the mouth of the river which is on the equator. Nevertheless, the G explorers, the brothers Denhardt, have plant German flag at Vitu, thirty German miles so the river Juba, and six miles inland. The ex report the district as fertile. A German squ consisting of three frigates and two transpor been sent to the coast of Zanzibar to protect th annexation; to which, of course, the sultan o Three German exploring expeditions have a started from Vitu for the interior of Africa.

SCIENCE.

FRIDAY, JULY 10, 1885.

A WESTERN SCHOOL OF BOTANY.

In anticipation of the full development of his noble foundation for botany and horticulture at St. Louis, Mo., Mr. Henry Shaw, the venerable founder, has specially endowed a school of botany in Washington university, which will for the present be served by a professor and a laboratory assistant. Professor William Trelease of the Wisconsin state university, a doctor of science of Harvard, has been called to this chair; and we understand that he will accept this hopeful position. When, in the course of time, the Missouri botanic garden, which Mr. Shaw originated, and has for many years so sedulously nourished and supported, comes with its generous endowment into completer connection with this school of botany, it will be seen that this central city in the valley of the Mississippi, happily placed for the purpose, is to have within its bounds an ample establishment for the promotion of botany and its dependent branches (such as arboriculture and horticulture), in the way of scientific advancement as well as of practical and educational teaching.

We understand that a laboratory and its appliances, sufficient for the present, will be supplied at once at the university in the city. But eventually the principal work of the school will probably be carried on at the garden at Tower Grove, adjacent to the park (a gift of Mr. Shaw to the city), which of itself will nearly serve for an arboretum. Here an adequate botanical library and an herbarium (both essentials) will doubtless be provided: we believe there is already a foundation for them. And so, if Mr. Shaw's long-cherished intentions and bountiful provisions are wisely carried into effect, the city in which Engelmann, alone and unaided, pursued his botanical investigations for a lifetime, may before long rejoice in the possession of much better facilities and larger means for botany than any other part of our country has now, or is likely to have. May the success of the new school of botany be commensurate with such advantages!

SANITATION AND SCIENCE.

Practical sanitation is devoted to the prevention, avoidance, or destruction of the causes of disease and death, and is founded on our knowledge of these causes. This knowledge is the scientific aspect of hygiene, or what many call sanitary science. It is at present very fragmentary and imperfect. Our powers of prediction as to the effect which certain circumstances will produce on the health of an individual or a community are limited, and in many cases we cannot, with any approach to scientific precision, explain why a given locality is, or is not, unhealthy. The first step towards a scientific investigation of a phenomenon must be the verification of its existence; but in much the larger portion of this country we can obtain little positive information as to the extent to which the inhabitants of a given place are liable to special forms of disease, or even as to the death-rate to which they are subject.

Until within a comparatively recent period, the method which has been almost exclusively employed in the investigation of problems of public hygiene has been that of observation of general and special mortality rates in different communities, and of endeavoring to connect the results of such observations with the circumstances of the environment in order to discover the causal relation between the two. But in such complicated biological problems as these, in which the result observed may depend on the concurrence of many causes or circum-

stances, it is usually very difficult, and often impossible, to obtain precise knowledge by mere observation of results, even when such observation can be made accurately. The most rapid and satisfactory progress is made when we can subject the problem to the test of experiment, and, by varying the conditions at our pleasure, can thus determine those which are essential to any particular result which may appear.

This experimental method is now being applied to sanitary questions, and especially to those connected with the prevention or suppression of the infective or spreading diseases, which are those of most interest in public hygiene. We can now study the causes of splenic-fever, erysipelas, infectious pneumonia, tuberculosis, glanders, and probably cholera, in the laboratory as well as in the sick-room; their causes may be cultivated, like plants, and the effects of various foods, temperatures, etc., upon them determined; and the efficacy of means proposed for eradicating them may be tested by direct experiment.

It is true that as yet comparatively few diseases can be thus investigated; because for the majority we have not yet found any animals, other than man, who are susceptible to them, and we cannot use man for inoculation experiments. We cannot say whether we have present in a specimen of water or a piece of clothing the specific cause of typhoid-fever, or of yellow-fever, or of scarlet-fever, except by tests applied to man; and hence we can only surmise with more or less probability as to whether such causes exist in a given well, or ship, or bale of rags. Nevertheless, the progress has been so great during the last five years, that we have every reason to hope that science will before long be able to use her right hand (experiment) to aid her left hand (observation) in unravelling not a few of these tangled skeins.

It is no longer a satisfactory explanation of an outbreak of diphtheria or typhoid to say that the place was filthy: if that were a sufficient cause, there are few towns that would not soon suffer from epidemics of these diseases. The apparent anomalies in the distribution of disease, which are apparent to every one who has investigated the subject, — the good health of persons who work in the midst of offensive effluvia and typical filth, the progress of an epidemic along one side of a street while the other side is free from disease, the people who drink dilute sewage with impunity and enjoyment, — all these things are illustrations of our own ignorance, and not of variability in natural law, to which all alike must be subject.

For every person who is affected with typhoid, or cholera, or tubercle, there are fifty who, so far as we can see, have been exposed to the same causes, and remain unaffected. It is easy to find instances where children have slept with others affected with scarlet-fever without contracting the disease. We cannot say to a person, "If you let your child visit his playmate sick with scarlet-fever, he will contract the disease:" we can only say that it is very probable that he will do so. In like manner, we cannot say to the inhabitants of a town or village where the wells are within a few yards of leaky privy-vaults, "You will have typhoid or cholera:" the probabilities may be only one out of four or out of ten that this will happen.

Sensible people take some precautions when their cattle are in such danger: they insure their houses and barns against much smaller probabilities of loss, but they have not yet learned that it also pays to insure against disease.

This instruction must be given them, not in the form of spasmodic declamation and vague threats, but as clear, definite information, distinguishing carefully between that which is known, or sanitary science, and that which is only more or less probable; and scientific investigators, whether chemists, geologists, biologists, or physicians, must all aid in the work. Their special knowledge gives them power, and it also imposes on them responsibility, — a responsibility which, if neglected, may result in crippling their chosen work and filling their own homes with sorrow.

QUARANTINES AND THEIR SCIENTIFIC VALUE.

THE outbreak of cholera in Europe during the past summer has naturally awakened a lively interest in precautionary measures to prevent its access to this country. The experience of all epidemics shows that among the chief and first obstructions suggested is that of quarantines. From their early application against the progress of plague in Italy, to their latest use during the past summer to prevent the introduction of cholera in Spain and Italy, this institution has met with indifferent success in preventing the spread of an epidemic; so that to-day the practical question of its efficacy remains still unsettled in the minds of many. Indeed, there is a large and influential number who inveigh against all quarantine measures as useless in a sanitary point of view, and as causing needless obstructions to the free intercourse of persons and commerce. It will be the object of this paper briefly to review the position, and establish, if possible, a reliable stand-point from which the work of sanitarians may be rationally carried on.

To approach the subject properly, we must first disabuse our minds of many European prejudices and ideas. So much of our medical literature comes from these sources, that we insensibly adopt conclusions drawn from these writings, without considering the differences of geographical position, and the facility which this gives us of employing measures which may be impracticable in most of the European countries. While this would eminently be the case, even were the conclusions reached by European governments founded on the recognized natural history of epidemics, another element of distrust is presented when we know that other factors enter into and bias their writings.

Governmental jealousies, geographical positions, impeded commercial relations, the difficulty of demonstrating an intangible element, with the consequent contrariety of opinions, have each and all tended to perpetuate the diversity of measures taken by different governments to obstruct the progress of a scourge. The several international sanitary congresses which have from time to time been held since the outbreak of the first cholera epidemic in 1831, have rarely been harmonious in action, adopting their conclusions mostly by a majority vote, or, if harmonious, the governments they represented have often failed through interested motives to give them cordial force and efficiency. Particularly is this notable with the English. Cholera is endemic upon a large area of her richest possessions. Her commercial relations with these countries are constant and immense. Any action taken to repress the spread of cholera must contravene more or less these relations, and is met either by evasion, or distinct refusal to adopt such action.

Her medical men insensibly imbibe the same spirit; and we find her medical literature teeming with articles on 'epidemic influence,' 'non-contagiousness of cholera,' the 'non-efficiency of quarantine,' 'cholera purely a filth disease,' etc.

While there is much in these writings which should command respect and attention, particularly in all that pertains to local sanitation, we should notice that their principal value lies in restricting and jugulating a scourge once admitted, rather than preventing in the first instance its ingress to the country. The geographical position of the different nationalities of Europe with respect to one another precludes the application of the principles of quarantine as understood in this country. Land quarantines have always proved ineffectual: and there is but one spot where quarantine applied to vessels can hope to be effectual against the incursion of cholera; that is the one established within the past few years at the island of Camaran, at the entrance of the Red Sea. In a paper recently published, I have detailed the principles and purposes which actuated the European international sanitary commission in its establishment.[1] If the regulations established at this point are faithfully carried out, the danger from cholera, so far as its transportation by Mohammedan pilgrims is concerned, should be effectually prevented.

Before making our estimate of the efficiency of quarantine measures to prevent the incursion of an epidemic, we must consider for a moment the position of this country with reference to the two great scourges which it is desired to contravene. In no part of this country are cholera or yellow-fever endemic: neither can reach our shores except through the intervention of shipping. The time of transit from Europe is longer than the incubative period of cholera; to all northern ports, from Havana, it is nearly equal to the incubative stage of yellow-fever: disease, therefore, contracted before going on the ship, would be developed before arrival at our ports. We shall see, when we speak of the detail of measures for repression, that a vessel, so far from being unfavorable, is really an efficient spot to jugulate cholera. The same rule does not apply to yellow-fever.

[1] New-York *Medical record*, April 18, 1885.

But what, then, is quarantine as understood in this country? Is it mere blind repression, established through the instinct of fear, and calculated to obstruct all intercourse among nations, both personal and commercial? Dealing with intangible agencies, is it equally vague in its principles of repression? The term is an unfortunate one; for it naturally carries us back to the derivation of the word, with all its inconveniences and sufferings of detention, its useless and blind precautions, its superstitions and silly forms as practised for centuries in the south of Europe, and as enforced in Spain and Italy even during the past year. It has no such meaning to-day, but comprises the whole series of measures, hygienic as well as restrictive, employed to contravene the incursion of an epidemic. These are not limited to those taken at the port of arrival of a vessel, but include those which in my judgment are far more important, — the inspection of passengers and *luggage* before embarkation, the systematic inspection of passengers in transit, and, finally, their observation and inspection on arrival at port. The underlying principles upon which its workings are based, are the modes of transmission, and the period of incubation of the disease to be contravened. Intelligent quarantine, while working on these principles, will vary the details according to the locality to be protected, and the particular disease to be excluded. The series of measures necessary to repress cholera would in no way be applicable to the exclusion of yellow-fever, for they are transmitted by wholly different agencies. Cholera, while the most pandemic of all epidemics, is also among the most contagious, or, rather, secondary influences enlarge widely the sphere of the contagious influence; while yellow-fever, limited to certain zones and altitudes, is non-contagious, its transmission depending wholly upon the surroundings of man. Strange as may seem the assertion, a ship should be one of the best places to jugulate cholera; for if due precautions of cleanliness, and disinfection of discharges, are promptly made, we avoid the secondary sources which arise from soil and contaminated water. On the other hand, yellow-fever, appearing on shipboard, can have no ending, so long as there is fresh material upon which to feed, short of seeking a zone where it loses its virulence, or discharging the vessel, and subjecting it to the most minute cleansing and purification.

In an article of this kind, it is unnecessary to recite the details of measures of repression of the two diseases, based on the above principles. I have already done so in the article 'Quarantine,' in Buck's 'Hygiene,' and the paper referred to, lately published in the *Medical record*. There are, however, two or three points to which it is well to refer, and the discussion of which may correct popular misapprehensions. I have stated that the time of transit from European countries to our shores is longer than the incubative period of cholera. If, therefore, by careful inspection of all soiled clothing at the point of departure, this factor for conveying the disease is eliminated, we have only to watch the development on shipboard of such cases as may have acquired the disease before coming on the vessel. The moment a case is recognized, or even suspected from any diarrhoeal discharge, it should be promptly isolated, attendants quarantined, discharges at once disinfected, all soiled clothing promptly destroyed, attendants' hands washed for the slightest stain, and it would be promptly suppressed. There is here but the primary factor with which we have to deal. The secondary ones, of contaminated water, floating germs, and conditions of the soil, are absent. If efficient measures are taken, a ship should be a favorable place to repress the disease. It would remain, then, for the land quarantine to maintain the vessel under observation for the requisite time to determine that no new cases occur. A series of measures which would suggest themselves promptly to any health-officer should be taken; such as the removal of all from the vessel to a spot of absolute isolation, the thorough cleansing and disinfection of all the cabins, linen, etc.

While yellow-fever may be transmitted by any of the surroundings of an individual, its favorite habitat is in the filth which accumulates in the bilge of a vessel. Nothing short of reaching this filth, and removing it with the most scrupulous care, can insure a protective influence. Disinfectants, fumigations, great heat in its various applications, are but secondary adjuvants, to be employed only after most scrupulous cleanliness has been effected. I believe in the efficiency of quarantine, if the measures recited cursorily above are rigidly carried out. They are measures to which the most minute attention must be given in every detail. The neglect to carry out any single provision will cause failure, and throw discredit upon the system.

It is a subject of interest to consider the influence of steam-navigation upon the dissemination of cholera and yellow-fever. As neither disease travels faster than man himself (for I discard the theory of 'epidemic influence'),

it would seem, at first view, that the increased rapidity of travel would also disseminate more rapidly the scourges; and yet it has seemed to me the practical working is the reverse. Those familiar with the history of cholera among the Mohammedan pilgrims are aware that since the abolition of caravans, and the transportation of pilgrims by steamers, very many fewer cases of cholera occur at Mecca, and along the land route from Dejeddah. It is because all are kept, so to speak, in a certain lane, where they are under constant observation; their food and hygienic surroundings are more carefully regulated; and cases occurring can be promptly treated and guarded. The same is true of steamers bringing emigrants to this country. With competent medical officers, isolated hospitals, absolute cleanliness of attendants, and prompt disinfection of discharges, the disease should be limited to those who had contracted it before coming on board, and virtually suppressed by the time of their arrival at any one of our seaports.

This influence of steam-communication is more striking, though in a different way, with reference to yellow-fever. In the great majority of cases, the vessel is the means of transportation; and the particular place of preference for the poison is, as stated above, in the filth which accumulates in the bilge. In sugar and milado carrying vessels, this, in a tropical climate, soon develops fermentative action. Until within a few years, the commercial history of vessels trading with yellow-fever ports has been as follows: A European cargo is taken to Havana, discharged, and the vessel lies an indefinite time empty in an infected port, seeking a charter for some seaport in the United States. No particular precautions of cleanliness are taken, either as regards the vessel or the crew. In most cases the fever appears while lying in port. A cargo is at length obtained, which adds to the filth of the bilge already infected. A better nidus for the propagation of the poison could not be formed; and under a tropical sun, sealed hatches, and stagnant air, it intensifies with great rapidity. An experience of several years showed that the majority of cases brought to the port of New York were on vessels of this character. Within the past ten years a radical change has been going on, and steam-transportation has largely replaced sailing-vessels, and with it there has been a large diminution in the number of the cases of yellow-fever. Steamers belong to regular lines, which make frequent and regular trips, remain but a short time in port, and are therefore rarely infected. Being of iron, their construction enables one to reach the bilge with facility, while the steam-pump flushing it keeps it clean: there is no wood to saturate and become infected. A steamer, too, carries the cargo of several sailing-vessels, and lessens the risk in that proportion. So far, then, from the rapidity of steamers facilitating the spread of cholera and yellow-fever, they have been the means indirectly of retarding both.

It could also be easily shown that the long antagonism between commerce and quarantine has entirely passed away. Instead of vessels riding an indefinite quarantine, our knowledge of the natural history of the two diseases tells us that the sooner a vessel is emptied, the less the danger of transmission of disease. Vessels, therefore, in quarantine, are returned to commerce sooner than if they went to dock, and discharged through the usual routine.

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HOW TO DEAL WITH YELLOW-FEVER.

IN closing a report on the yellow-fever epidemic of 1873, made in response to a resolution of the U. S. senate, the present writer used the following language: —

"It may finally be added, that, in the absence of other adequate cause, the gradual narrowing of the yellow-fever zone in the United States during the past fifty years — say, from the time when leases in New-York City frequently contained a provision for reducing the rate of rents in the event of a depression of business from the advent of cholera or yellow-fever — may be fairly claimed for the sanitarian and his efforts; and that in such efforts lies all there is of promise for the future in dealing with yellow-fever."

This was written before the brilliant results of the investigations of Pasteur and Koch had opened up the tempting field which Ferrán and Domingos Freire already claim to be successfully cultivating. It may be that these gentlemen have actually accomplished — the one for cholera, and the other for yellow-fever — what Jenner, Pasteur, and Koch have done for other diseases; and although this is not yet proven, and, in the nature of the case, will require considerable time to demonstrate, there is scientific ground for believing that immunity against these pestilences will eventually be secured through a process analogous to that by which vaccination has disarmed small-pox of its terrors. Until that desideratum is reached, however, the precautions which should be taken to provide against yellow-fever will

continue to be those indicated in the sentence above quoted.

Whatever the yellow-fever poison may ultimately prove to be, enough is already known of its characteristics and limitations to enable us to formulate specific measures of such precaution. For practical purposes, we are not concerned with the many theories regarding its origin, — whether it was first engendered during the horrors of the 'middle passage' in the hold of an African slaver, or in the putrefaction of the abundant marine life of the Sargossa Sea, or by the action of atmospheric forces peculiar to the equatorial Atlantic, or by the spontaneous development of a specific organism. It is sufficient to know that there is such a poison, and, 1°, that while it does not originate in this country, it may be conveyed from place to place; 2°, that it is a poison of considerable specific gravity, infecting the lowest stratum of the atmosphere, and possesses great tenacity, clinging to surfaces; 3°, that it flourishes amidst filth, under certain conditions of temperature and moisture; and, 4°, that the disease which it produces is essentially one of cities and crowded populations.

Upon these characteristics must be based the precautions to be enforced, and first with regard to communication with places where the disease is endemic. A quarantine of absolute exclusion is demonstrably impracticable, owing mainly to the many facilities which steam enables commerce to command. Much, however, may be done in this direction by a quarantine of inspection and sanitation. To this end it is necessary, that, within the geographical limits where yellow-fever may become epidemic in the United States, a system of sanitary supervision over personal and commercial intercourse with places where the disease exists endemically be established and maintained during the season when the atmospheric conditions necessary to its epidemic spread obtain in this country. This would dictate specifically that such supervision over commerce with South-American ports lying north of 22° south, with the West Indies and the Bahamas, and with the east coast of Mexico, should begin in April at the Gulf and South-Atlantic ports, and in May at ports north of 32° or 33° north, and should continue until the close of October and September respectively.[1]

[1] Of a hundred and seventy-four epidemics, of which the date of beginning has been accurately recorded, three began in May in places south of latitude 33° north, but none earlier than June in places north of Charleston (32° 46′ north): four began as late as October in the former, but none later than September in the latter. Hence south of Charleston the danger season begins in April, and ends in October: north of Charleston it begins in May, and ends in September.

The supervision should consist of an inspection of every vessel arriving from the region specified, and of treatment, which will vary, 1°, with the actual sanitary condition of the vessel, her cargo, belongings, and *personnel*, including in the sanitary condition the facts as to age, material, and previous yellow-fever history; 2°, with the sanitary status of the port of departure; and, 3°, with the climatic and other conditions of the port of arrival. Within the limits assigned to this paper, it is not possible to enter into the details of this treatment. They are well understood by practical sanitarians, and their sufficiency has been demonstrated by the inspection services of the National board of health and the Sanitary council of the Mississippi valley, as well as in the quarantine practice of the port of New York and elsewhere; while a practical test of their value for the protection of the port of New Orleans is now being made by the Louisiana state board of health. The characteristics of the poison, as set forth in the second and third propositions, will indicate what methods of treatment by disinfection and cleansing are necessary.[1]

But no matter how perfect such a system of sanitary quarantine may be made, there is always the risk of the poison being introduced through some unsuspected, and therefore unguarded, channel.[2] To meet this risk leads to further consideration of the third proposition, — that the poison flourishes amidst filth.

Whether the disease is in its indigenous

[1] Assuming that yellow-fever is "due to a specific cause which is capable of growth and reproduction," and which is transportable, not only by adhesion to surfaces, but in the air from an infected locality; and that the "growth and reproduction of this cause [i.e., the yellow-fever poison] is connected with the presence of filth, in the sanitary sense of that word, including decaying organic matters and defective ventilation," — it follows that closed vehicles, compartments, or receptacles, and articles or masses of material capable of retaining air motionless in meshes, folds, webs, or interstices, are dangerous as contagion-carriers in proportion as their character, use, or structure prevents or retards aeration, and in proportion as such articles or materials furnish organic matter liable to decay: hence an empty box-car, or the unventilated hold of a vessel in ballast, may be the means of introducing the poison by transporting infected atmosphere . . . [extract from a "Memorandum for the classification of articles of merchandise for quarantine purposes," drawn up by the writer, and adopted by the Sanitary council of the Mississippi valley, April 21, 1881].

It will be seen from the above that the disinfection necessary for yellow-fever is essentially different from that laid down by the recent International sanitary conference at Rome as sufficient for cholera. In the report of the committee of that conference on the question of disinfection, and which embraces such eminent men as Koch, Sternberg, and Proust, it is specifically stated that 'disinfection of merchandise and of the mails is unnecessary;' while, of atmospheric disinfection, no mention whatever is made in the report. That these are both essential for yellow-fever, is, in the opinion of the writer, beyond question. His personal experience during the epidemics of 1878-79 alone — notably, that on the relief-boat Chambers, in connection with the infection of Lieut. Benner and others — is to him conclusive on this point.

[2] Intercommunication with Mexico by rail, for example, suggests one mode which as yet has not been provided against; although an extension of the system of sanitary supervision to railroad intercourse is entirely feasible, as has been shown during the past few years by the operations of the inspection services above referred to.

home, or imported, the testimony is uniform that epidemics of yellow-fever have their starting-points in the lowest, filthiest quarters of seaport towns, than which nothing can be filthier or more disgusting. It can hardly be necessary to dwell upon this point. With the improvement in the water-side precincts of New York, Philadelphia, and other North-Atlantic seaports, yellow-fever has ceased to be the devastating pestilence which it was in the days of Benjamin Rush. In those days the purlieus of such cities were little better than they now are in the towns and cities of the Spanish main, where it still rages. In the latter, it is true, there is always present the added factor of a favoring condition of temperature; and, less constantly, this also affects our Gulf and South-Atlantic seaports. But this of itself should be an additional incentive to securing the best attainable sanitary condition. Foul drains, filthy streets, reeking gutters, neglected cloacae, excremental accumulations, decomposing garbage, rotting fruit and vegetables, the drainage of sugar and molasses casks, — the wonder to the sanitarian, as he views such scenes for the first time under the tropical rays of a summer sun, is not that yellow-fever occasionally occurs, but that pestilence in some form is not always present. In the endemic home of yellow-fever, 'sanitation' is an unknown term; and, in the degree that its import is ignored along our Gulf and South-Atlantic coasts, the disease finds favorable conditions for establishing itself whenever its poison is introduced.

An obvious precaution is suggested by the fourth proposition, — that yellow-fever is a disease of cities and crowded populations.[1] As a rule, it is limited not only to cities, but to sharply defined quarters of cities. The great specific gravity of the poison, and its property of clinging to surfaces, are shown in this limitation of extension. Frequently its rate of progress may be mathematically defined, so many feet per day, independent of any recognized influence, except a perpendicular obstacle. A board fence has been known to stop its progress, as in Mobile; or a bluff bank to hold it at bay for weeks, as in Memphis. Not only do the higher portions of a city suffer less than the lower, other things being equal, but the upper stories of individual houses are safer than the lower. Yellow-fever is essentially a local disease, its existence depending upon particular circumstances of place: hence, when the disease manifests itself in a locality, the imperative duty of the sanitary authority is to remove from the infected place (be it house, street, ward, or quarter) all those susceptible to it, — to depopulate the infected district, if it tends to become epidemic, by removal to camp, if only a few miles distant, as was done with such satisfactory results in Memphis during the epidemics of 1878 and 1879, and repeatedly before that time in the U. S. army. The *cordon sanitaire* may be employed to prevent people from going into an infected district; but with the present resources of sanitary science, and definite knowledge of this disease, its use to prevent escape from such a district is a barbarism of the same character as the old-time quarantine of detention.

In a word, the precautions to be taken against yellow-fever are the same as those which common sense and experience have shown to be adequate against the other exotic infective diseases: to wit, a thorough system of sanitary supervision and control of intercourse, both by sea and land, for the exclusion of the specific poison; and, supplementing possible (if not inevitable) defects in this, the destruction of the conditions necessary to the life and activity of the poison by general and local sanitary effort within our own territory.

F. W. REILLY.

[1] Its occasional extension to small places, and even to plantations and isolated houses, does not affect the general accuracy of this proposition. Such extension occurs only during widespread and virulent epidemics, when, it may be inferred, the specific poison is generated in such quantity and intensity as to be the more readily transplanted from place to place.

CHICAGO-RIVER POLLUTION.

IT is worthy of note that the first sanitary regulation made by the authorities of the town of Chicago had reference to the protection of the river from pollution. Nov. 7, 1833, the town trustees declared it to be unlawful "to throw or put into the Chicago River, within the limits of the town, any dead animal or animals, under a penalty of three dollars for every offence." More than half a century later, the problem of establishing and maintaining an inoffensive condition of this stream still demands the attention of the sanitarian. A glance at the topography of the region will facilitate comprehension of the problem, and assist in its solution.

While the western portion of Cook county is embraced in the general slope of the watershed of Illinois and the interior system of drainage of the State, — which is to the south and west, and ultimately into the Gulf of Mexico, through the Mississippi River, — the region of Chicago, embracing the greater portion of Cook county, drains naturally into the Gulf of St. Lawrence, through the Great Lakes

and the St. Lawrence River. The site of the city was once covered twenty feet or more by the waters of Lake Michigan, whose western rim, at no very remote period of geologic time, was some eight or nine miles west of its present position with reference to the city of Chicago. The recession of the lake resulted in the formation of a series of sand-dunes or ridges, with intervening ponds and lagoons, which gradually filled up with the humus of peat-producing vegetation. This formation was the original site of the city, with an average elevation of only twelve feet above the lake, and much of it being so low as to be subject to overflow, even by the ordinary variation of the lake under the influence of north and north-east winds.[1] Through this low, flat, swampy plain there eventually cut its way to the lake a narrow, sluggish stream, the present Chicago River. Forking about a mile and a half from its present mouth, its north branch runs in a direction generally parallel with the lake shore for a distance of some twenty miles; while its south branch, after running due south for about two miles, tends sharply to the south-west for a mile or more, and then divides into two smaller branches, the western one of which is separated from the Des Plaines River by a narrow 'divide' of only a few feet elevation. In seasons of high water, this 'divide' was formerly obliterated by the flow of the Des Plaines into Lake Michigan, and for several years an artificial communication has existed between these two streams through the so-called 'Ogden ditch.' In 1848 the Illinois and Michigan canal was completed, connecting this south branch of the Chicago River with the Illinois River at La Salle, ninety-six miles south-west; and in 1871 the summit-level of the canal, twenty-six miles long, had been lowered from twelve feet above, to eight feet and a half below, the ordinary level of Lake Michigan: so that, theoretically, the Chicago River now rises in Lake Michigan, and empties into the Mississippi through the Illinois and Michigan canal and the Illinois River. The primary object of the construction of this canal was purely commercial, but it has since become one of the most important factors in the sanitary welfare of the city.

As the cholera epidemic of 1849–50 led directly to the introduction of lake-water, and the foundation of what is, in some respects, now the most magnificent system of water-supply in the world, so the repeated epidemics of cholera and dysentery led to the adoption, in 1856, of a system of sewerage, which, within twenty-four years thereafter, had furnished more linear feet of sewers *per capita* of population than in any other of the large cities of the Union. For fourteen years (1843–56 inclusive[1]) the average annual death-rate of the city had been 37.91 per thousand, probably the highest of any city in the United States; during the first fifteen years of sewer-construction (1856–70), the average annual death-rate was reduced to 23.97 per thousand; while, from 1871 to 1884 inclusive, the average has still further fallen to 21.40 per thousand. And although there have been marked fluctuations from year to year, — rising to 32.22 in 1866, and falling to 16.49 in 1878, — on the whole, there is, as I have shown in a table published elsewhere,[2] a striking correlation between the annual death-rate and the number of feet of sewers *per capita* year by year, independent of all other influences.

But while the sewerage of the city has been one of the most important agencies in this reduction of the death-rate, it has necessarily added to the pollution of the river and its branches, and from time to time has affected the purity of the water-supply. To such proportions did this evil speedily attain, that in July, 1860, — only four years after the system was adopted, — the sewerage commissioners recommended that the canal be deepened and enlarged, so as to create a constant current from the lake into the Illinois River, as a measure indispensable to the protection of the health of the city. The recommendation was not heeded at the time; and for some years thereafter, Mr. Chesbrough, the sewerage engineer, continued to urge, as a practical measure of temporary relief, the construction of covered canals or aqueducts from the lake, with apparatus for forcing lake-water through them into the north and south branches respectively, and so to create a current from the river into the lake, pending the construction of a system of intercepting sewers or the deepening of the canal, — both of which measures he had ably discussed from time to time, from the year 1855.

Meanwhile the volume of sewage and of offal from the slaughter-houses and other sources, pouring into the river, continued to increase with alarming rapidity; and although the foul-

[1] The highest point above the level of Lake Michigan, for fifteen miles north, is only thirty-eight feet; and south-east for the same distance, only twenty-three feet. Directly south of the city, the surface is almost level, the highest point within sixteen miles being only twenty-two feet. Southwest for ten miles the highest point is only ten feet, where, at the Summit, the waters of the St. Lawrence run north-east, and those of the Mississippi south-west. From the Summit there is a gradual descent, until the ground is lower than the surface of the lake.

[1] Certificates of causes of death were first required in 1841, but records were not begun until June 1, 1851.

[2] 'The sanitary problems of Chicago, past and present.'

ness was occasionally mitigated by the action of the pumps at Bridgeport, raising water from the south branch into the canal as needed for navigation, it was not until the spring of 1865 that it was finally decided to deepen the canal, as had been recommended in 1860. A remarkable epidemic of erysipelas, which prevailed exclusively along the south branch and main river in 1863, and which was obviously caused by the unspeakable filth of these streams, had undoubtedly much to do in securing this decision; but the efficiency of this mode of relief had been incidentally shown by the action of the pumps at the head of the canal. The work was begun in the fall of 1865, and completed in July, 1871; but even before it was completed, the water-supply, taken from a point about one-fourth of a mile from the shore, had been so often affected by the current from the river, that a tunnel under the lake, running out two miles farther, was constructed, for the purpose of getting the supply from beyond the area of river-pollution.

Relying upon the deepening of the canal to establish and maintain a cleansing current from the lake through the river, the pumps at Bridgeport were removed when the 'deep cut' was completed, notwithstanding which there was for some time a decided improvement in the condition of the river. Gradually, however, the increased sewage-production of the rapidly growing city, a diminution of flow through the canal due to various causes, and the fluctuations of the lake-level, indicated the necessity for further effort.[1] In 1871 the construction of the 'Ogden ditch' was begun; and after its completion another factor was added to the problem, — a factor which acquired additional importance, when the dam and floodgate intended to regulate the flow through the ditch were broken down, and became inoperative. The Des Plaines pours through this ditch into the south branch a volume often greater than the entire capacity of the canal. Every cubic foot of this water reduces by so much the inflow of the lake through the main river and south branch into the canal, and thus causes a concentration of the pollution.

In 1881, after careful study of all the conditions, I urged the re-establishment of the pumping-works at Bridgeport, recommending that their capacity be made sixty thousand cubic feet per minute, and subsequently pointed out the necessity for the re-establishment of the dam at the 'Ogden ditch.' An appropriation was promptly made for the pumping-works, and these were completed late in the fall of 1883; but thus far they have not pumped over thirty-five to forty thousand cubic feet per minute. Within a short time an appropriation has also been made for the repair of the dam.[1]

At the present time the fouling of the river and its branches from the blood, offal, and wastes of the slaughtering and packing establishments and their subsidiary industries, has been materially reduced by the utilization of much which was formerly considered worthless, and consequently was thrown into the river or upon the surrounding prairies. On the other hand, the volume of sewage proper has increased with the growth of the population and the extension of the sewered area, until a daily sewage-production, which may be roughly estimated at from forty-five to fifty million gallons, is now poured into the river and its branches. With the exclusion of the waters of the Des Plaines River from the canal, and the continuous operation of the pumping-works, this sewage need never be allowed to find its way into the lake, except for a short time during the spring thaws, or as the result of unusual rainfalls; and these exceptional occurrences will not then entail serious consequences, owing to the permanently improved condition of the river and its branches, resulting from the continuous removal of the sewage, and the cleansing effect of the steady influx of lake-water.

It should be stated that provision is made for the purification of the north branch of the river, as originally suggested by Mr. Chesbrough, through a conduit from the lake, with pumps capable of pouring eighteen thousand cubic feet of water per minute into the branch at Fullerton Avenue. To prevent this from creating a current into the lake through the

[1] The lake is highest in July and August, and lowest in December and January, the average fluctuation being about three feet. Occasionally it is much greater than this: for example, on one occasion in February, 1875, the stage of water at the head of the canal was only five feet and eleven-hundredths, while for a short time in April, 1877, it was fourteen feet. Local rains on the watershed of the south branch, or on the area drained by the summit-level of the canal, or high water in the Des Plaines pouring into the south branch through the 'Ogden ditch,' — all operate, to a greater or less extent, in the same way that a low lake-level does; that is, the current in the south branch and main river is suspended or reversed, and, instead of flowing off through the canal, the sewage is carried into the lake in dangerous proximity to the in-take of the water-supply at the 'crib.' This condition obtains every spring for varying periods, and during the spring just closed it was frequently observed. A local rain on the 2d of this month (June) created a current from the river, which continued for several days, the effect being perceptible for some distance beyond the 'crib,' until counteracted by north-east winds.

[1] When this is completed, it may be necessary to convey the flood-waters of the Des Plaines to Lake Michigan, at some point north of the city, in order to obviate the danger of inundating the town of Joliet by freshets from a watershed of some twelve hundred square miles. This, however, and the treatment of local areas, are matters of detail which present no features not easily mastered; as, for instance, the fork of the south branch which runs near the Union stockyards, now a foul cesspool. To bring this within the general system requires that an adequate volume of lake-water be poured continuously into the head of the fork, washing its contents, properly diluted, into the south branch, to be thence pumped into the canal.

main river, it is additionally necessary that the Bridgeport pumps be continuously operated.[1]

From causes already indicated, — namely, by the more perfect utilization of wastes and refuse which formerly added to soil and water contamination, and by thorough sanitary supervision and control, — it is probable that the pollution of the Chicago River will be due mainly, in the future, to the sewage proper of the city. This, of course, will increase with the increase of population and the extension of the sewer system. But I estimate, that, at the present time, the river and its branches may be kept in a fair sanitary condition, and the sewage diluted so as to be inoffensive, by causing a flow of from forty-five to fifty thousand cubic feet per minute through the canal: sixty thousand cubic feet will probably be sufficient when the population has increased to seven hundred and fifty thousand. If, by the time the present capacity of the canal is reached, the proposed plan of converting it into a ship-canal has not been realized, it may be necessary to seek additional relief through the Des Plaines River. Pumping-works at the 'Ogden ditch,' discharging into the Des Plaines, may then be used to supplement the discharge into the canal; and for many years these two systems will be adequate to prevent any serious pollution of the Chicago River, will protect the water-supply from contamination, and will relieve neighboring communities along the canal and Illinois River from the nuisance heretofore frequently caused by the sewage-disposal of Chicago.

John H. Rauch.

[1] The Fullerton-Avenue conduit was constructed, and the pumping-works arranged, so as to discharge the contents of the north branch into the lake through the conduit, or to convey lake-water into the branch. The former method is contrary to the correct principles of the sewage-disposal of Chicago, and must ultimately be abandoned.

SOILS AND HEALTH.

The soil, especially the first few inches or feet below the surface, is the ante-chamber of life, — the laboratory in which operate incessantly the processes by which inert matter is prepared for the nourishment of life. It is this, because it is also the tomb of all terrestrial living matter. Here is the realization of the Phoenix-myth; the slow combustion of organic matter leaving a residuum, from which springs the new life of succeeding generations.

These processes of the transformation of matter are the work of the low forms of microscopic life which are known as bacteria, and are gifted with the capacity of enormous and immensely rapid multiplication. This world of microscopical life is vast as regards the distribution and number of its living entities. These minute organisms are known to be intimately connected with many of the fundamental processes of the organic world, and our knowledge of their range of activity is constantly increasing.

They may be considered practically to stand in close genetic relations to many diseases; but the question of absolute differentiation of forms with specific functions, or of the possibility of Protean functional characteristics among them, varying with their surroundings, is one of the present great problems of biology.

The great majority of pathologists now consider the infectious, and most of the contagious, diseases to be dependent on these low forms of life; and the tendency is, to consider that certain diseases or groups of diseases are produced only by specific forms of bacteria.

These organisms are wide-spread, especially the various forms that are associated with putrefaction and mould. Only on high mountains, and far from land on the ocean, is the air practically free from them. Elsewhere the air, water, and soil teem with them. Their abundance is necessarily proportionate to the amount of decomposing organic matter in the neighborhood, since they are themselves the scavengers, on which the processes of decomposition depend.

Few people realize what an important part the soil plays in our lives. The water we drink (unless from cisterns) has leached through it. The air we breathe is frequently loaded with its dust. It is in our food.

The soil is highly porous; and the interstices between the grains are filled with water or with air, — 'ground-water' or 'ground-air.' The ground-air fluctuates with the varying barometric pressure, and with the rise and fall of the ground-water in rainy and dry seasons. The ground-water flows according to the common laws of hydrostatics, but with a movement retarded by friction.

A town on a river-flat is built over a continuous sheet of slowly moving subterranean water, and most houses are built where water is accessible within a few feet from the surface. In view of the fact that our wells and the cellars of our houses are in more or less close proximity to these centres of pollution, it was thought desirable to ascertain to what extent the different soils act as filters in arresting the spores of bacteria. This investigation, which was carried out for the National board of health by the writer, assisted by Dr. Smyth, brought out very clearly three facts: —

I. All soils finer than very coarse sand have practically a continuous capacity for arresting the spores of bacteria from infected *air* filtering through them.

II. No soil, no matter how fine, can arrest and hold back the spores of bacteria contained in *water*. The experiment on which this statement rests consisted in filtering unsterilized water through one hundred feet of pipe filled with fine sand which had been sterilized by heating to a red heat. This pipe was connected by an air-tight joint with a flask of sterilized beef-infusion, and the whole apparatus left for several weeks before use. The first drop of water that passed through these hundred feet of sand infected the beef-infusion, causing it to putrefy.

III. Neither bacteria nor their spores can detach themselves from a liquid or from a wet soil, and pass into the air, except through the conversion of the water into spray, or through the formation of dust by evaporation.

The chief practical inferences from these results are, that distances, even of hundreds of feet, between wells and cesspools, are no protection against infection, and that a dry or an alternately wet and dry cellar may be more dangerous than a permanently wet one.

These results emphasize the importance of an intelligent survey of the condition of the soil in selecting a home, and of a legislation prohibiting the pollution of the soil.

In many towns and cities, the privy-vaults and leaching cesspools of every house drain really into the sheet of ground-water: the soil arrests the coarse material, the grease and slime; but the swarming bacteria diffuse with ease, as much as the soluble chlorides and nitrates, and follow the flow wholly unobstructed. Into this same soil are sunk or driven the wells; and the water that is drawn for use is polluted in proportion to the number and proximity of the vaults and cesspools, on the one hand, and the thinness and sluggishness of the water-sheet, on the other. In the worst wells in daily use, the water is distinctly colored with sewage; but the most deadly water may carry only the germs of typhoid-fever or of dysentery, and be otherwise sparklingly clear, and so pure as to pass unchallenged through the most searching chemical analysis.

If the soil is polluted and very coarse gravel, this indraught, loaded with the spores of bacteria, will flow through the cellar to the warmer rooms. If the soil is polluted and fine, and the ground water-surface rises at any season to the level of the floor, or higher, it will evaporate as it oozes into the cellar, and leave an infected dust to be taken up into the circulation of the house-air. Similar results will follow from the leaching of the cesspool toward the cellar-wall, or from the filtration through the soil of sewage from a broken or leaky drain; which is very apt to exist in or just outside of the foundation-wall. The pollutions of soil and water already mentioned are of such a general character, that, with ordinary forethought, they can be guarded against; but there are others of a local character which are not revealed to a general survey. In the growth of many of our cities, the natural topography is disregarded. Lowlands and marshes which are traversed by sewage-fed brooks are covered with a network of high-graded streets, which convert the blocks into sewage-basins, which come, in time, to underlie blocks of dwellings of all classes.

In other cases, low or marshy ground is made the dumping-ground of the city, and receives the sweepings of the street, the contents of the ash and garbage barrels, — every thing, in fact, that cannot pass through the sewers or be sold. The entire material is loaded with organic matter which is kept in a state of very slow decomposition by moisture.

Some of the costliest dwellings of our cities rise upon such soil. We may take every precaution to avoid in our homes the dangers that arise from a polluted soil, and may yet fall victims to the filthy condition of remote places, over which we have no control.

Among many others there are two exceptionally frequent sources of danger of this kind. One of these is the farmer's well, which is rarely safe, and, when not used to adulterate milk, is used to rinse milk pans and cans, and leaves upon their surfaces a source of contamination. The other frequent instance is the use, by druggists, of water from wells or from cisterns, which are often any thing but sewage-proof. Throughout the country, and often in the cities, the use of only distilled water in compounding medicines is far from universal; and I have had analyses made of lime-water bought at a druggist's, which was highly contaminated with organic matter. The druggist's well, moreover, is the source of most of the soda-water throughout the country, as well as in many cities where the water-rates are high. A person having a harmless disturbance of the bowels, arising from a cold, is just in the condition to succumb to the dysentery or typhoid-fever lurking in the medicine or Vichy-water from the too-much-trusted druggist.

RAPHAEL PUMPELLY.

CITY WELLS.

At a conference of state and municipal boards of health held at Washington last December, ten propositions were unanimously agreed to. The first of these is, 'that all surface-wells should be closed at the earliest possible moment.' This has special reference to the surface-wells in cities. Why do these wells deserve such sweeping condemnation? We have only to consider the conditions surrounding them, to have a reason suggested. In cities in which there are no sewers, it is well known that the discharges from the inhabitants are conveyed to cesspools, where they are allowed to remain indefinitely. Sometimes the contents of these cesspools are imperfectly removed; sometimes they are not disturbed, a new cesspool being dug in the neighborhood of one which has become filled. They are rarely built carefully, but are usually merely holes in the ground, lined with sufficient stonework to prevent the earth from falling in. In some cities they are dug in exactly the same way as the wells which are intended to supply drinking-water. The digging is in each case continued until water is reached. Communication is thus established with subterranean currents, and the refuse matter which finds its way into the cesspools is at least partly carried away. This saves some trouble; but what becomes of the refuse matter? Under very exceptional circumstances, it may find its way to some large body of water which is not used for drinking-purposes, and thus do no harm. If, however, there are wells in the neighborhood, the chances are in favor of the contents of the cesspools and of the wells becoming mixed. The larger the number of cesspools and of wells, the greater the danger of such a result. In a city not provided with sewers, therefore, the conditions are such as to lead almost certainly to contamination of the water of surface-wells with the contents of the cesspools. Besides this, there is the danger of contamination from surface-drainage, which cannot be avoided. The water which falls upon the ground, whether the ground be paved or not, sinks to a considerable extent below the surface, carrying with it such impurities as may be present. Such surface-water in cities, it is safe to say, is always contaminated. Some of it is sure to find its way into the wells.

This latter source of contamination is common to all cities, whether they are provided with sewers or not. While, however, the city which is provided with sewers is not subjected to exactly the same kind of danger as that first referred to above, the cases do not present as much difference as might at first be supposed. The sewers are generally leaky, and the soil in their vicinity becomes saturated with sewage. Thus they may contribute to the contamination of the well-waters. Of course, the danger of such contamination is not so great as when there are no sewers, but still it is quite sufficient to justify the condemnation of the surface-wells.

The waters of city wells have frequently been studied by chemists and biologists, and the results invariably show that contamination is the rule. In Brooklyn, N.Y., there were, in 1882, three hundred and sixteen wells. Chemical examination showed, "that, of this whole number, but seventeen furnished water fit for human consumption." Similar results have been reached in an examination of the water of the wells of Baltimore, where a few years ago there were between one and two hundred in use. The contamination of some of the waters examined was such as to show that very close connection must exist between the wells and cesspools. The testimony of all who have given special attention to the subject of the water of city wells is unanswerable. Not only does a consideration of the surrounding circumstances lead us to suspect that the water must be contaminated, but the most careful examinations, by those most capable of making the examinations, have shown that actually, and almost invariably, the water is badly contaminated.

It is an unfortunate fact, that, though the waters of city wells are generally impure, their external properties do not always reveal the impurity. Sometimes they do; and then it requires but a very slight hint as to the cause of the properties, to stop the further use of the water. Thus, for example, some years ago there was a spring in Baltimore, which, owing to its peculiar taste and odor, was regarded as a mineral spring. It was therefore fenced in, and covered, and generally treated like others of the class known as 'mineral springs.' It was afterwards found that very close connection existed between it and a neighboring cesspool; and the cause of the taste and odor which had given the water its reputation was thus revealed. It need not be added that the water ceased to be popular. More frequently these well-waters are clear, and without taste and odor, and, coming from greater depths than the service-water, they are generally cooler. Frequently, too, they are used for years, and many who use them continue in good health. There are, of course, in every community, many who are able to resist bad influences. They furnish

no evidence for or against the danger of using bad water. The influences are felt principally by the weaker members of a community.

As regards the specific objections which may be raised to using the water of city wells, it may be said, in the first place, that the evidence is pretty clear that water contaminated with sewage does at times give rise to low fevers. Though it is difficult to furnish satisfactory proof of the statement that the use of contaminated water tends to lower the general condition of health of those who habitually use it, those who have paid most attention to the subject unanimously agree that pure water is as important as pure air for the preservation of good health. One of the chief dangers in the use of water contaminated with sewage is, that, by establishing connection between the sick and the well, it contributes to the spread of some forms of epidemic disease. As is well known, it is now held by many of the highest authorities that in some diseases the organisms which are believed to be the active causes are given off from the patients with the alvine discharges. If, now, by any means, these organisms or their germs are introduced into the system of a well person, the diseased condition is set up. What more efficient method of distributing these organisms than drinking water which is contaminated with the contents of cesspools! Exactly what forms of disease may be spread in this way, it is difficult to say; but there is strong evidence in favor of the view that typhoid-fever and cholera are among them. Over and over again, outbreaks of typhoid-fever have been traced with practically absolute certainty to the use of water known to be contaminated by sewage. In regard to cholera, the evidence is quite sufficient to justify the destruction of all city wells.

IRA REMSEN.

THE SHIP-RAILWAY BETWEEN THE ATLANTIC AND PACIFIC.

THE article by Mr. Hubbard, in *Science* of Nov. 4, 1884, on canal routes between the Atlantic and Pacific, discussed briefly the advantages of the three routes and methods proposed. The object of the present paper is to present the scientific and commercial reasons why the ship-railway across the Isthmus of Tehuantepec may be superior to either the Panama sea-level canal, or the Nicaragua lock canal.

It is estimated that $50,000,000 will be ample to put the ship-railway into operation for the transportation of vessels of 5,000 tons. The estimated cost of the Nicaragua canal on a cash basis is $140,000,000, and of that at Panama, as high as $350,000,000.

The route *via* Panama, between Liverpool and San Francisco, is about 700 miles longer than by Tehuantepec; between New York and San Francisco, about 1,200 miles; and between New Orleans and San Francisco, about 2,000 miles. Probably 1,000 miles excess of distance would be a fair average.

The time in transit across the isthmus would be at least three days shorter at Tehuantepec than at Nicaragua for either a steamer or sailing-vessel. The Suez canal, which is 100 miles in length, delays a steamer 48 hours in transit, or her passage is at the rate of about two miles per hour: two-thirds of the distance is through the lakes, and there are no locks. At Nicaragua, about one-sixth of the distance only is through an open lake; and there will be from twelve to twenty locks, at each of which a vessel will be detained nearly an hour. The time required for passage, therefore, will be about four days; so that, although the total distance is shorter than at Panama, the time required for a steamer would be about the same.

In the article by Mr. Hubbard above referred to, reference has already been made to the favorable situation of Tehuantepec with reference to the trade-winds.

It is also hoped that the maintenance will cost much less per annum than that of either canal. The Panama canal being below the level of the sea, with the slopes of its enormous cuts exposed to the wash of the tropical rains, the difficulty of removing the material washed into its prism, and the controlling of the Chagres River, make the maintaining of the ship-channel difficult and expensive. At Nicaragua the conditions are nearly similar.

The ship-railway will not be subject at any point to the ravages of floods. It will be built over its entire length, on the solid ground, with excellent materials at hand for construction and maintenance. On either side is a natural harbor, which with small expense, by the construction of jetties, will give two excellent ports. The climate is remarkably healthy, and native labor abundant and cheap. It is located in a country which has a comparatively strong government.

The estimated total cost of maintenance and operation in lifting, hauling, and placing the vessel with its cargo in the water again, is less than thirty cents per ton of cargo carried.

The great doubt which must exist in the mind of the reader is in the practicability of lifting and hauling a loaded vessel. The method

proposed is very briefly this: to lift the vessel by an ordinary lifting-dock, distributing and equalizing completely the weight of the vessel by a system of hydraulic presses before the weight is brought upon the carriage which is to transport it. This is all done under the water, as the vessel rises out of it, and in such a manner as to be perfectly safe and easy for the vessel. The weight is finally placed upon the carriage in such a way that there is no more weight upon one wheel, or upon one part of the carriage in its length or width, than upon another. The weight upon no wheel will be over eight or nine tons, although they will be tested to twenty tons when manufactured. The whole load is transferred to the wheels by means of powerful springs, which will also be tested to twenty tons, and none of which will have imposed upon them in practice a weight of over eight and a half or nine tons. These springs not only give a perfect cushion for the vessel and carriage while being transported, but also serve to take up any slight irregularities there may be in the track. The system of supports designed, and shown in the working model, gives an area of support under the vessel from fifty to seventy-five times as great as that in the best lifting-dock in the world; and, moreover, these supports completely adjust themselves to the model of the vessel in each case. As it has been said frequently by practical experts in designing and building docks, and handling vessels in them, the *desideratum* is to have a sufficient number of adjustable supports, and this has been sought for in the plans for the work as shown in the model.

The railway road-bed will be about 50 feet in width; the width between the outer rails, about 30 feet. There will be six of these rails, weighing from 100 to 125 pounds per lineal yard. All six rails will be connected by a long steel-plated tie, set into two feet of broken stone ballast or concrete, as the case may be. The locomotive power as designed is to consist of engines of from 75 to 100 tons, each of which will haul at least 3,000 tons on a grade of as much as 40 feet to the mile; so that two, or at the most three, such locomotives will haul the maximum load. The grades are very light. Much of the line of railway is practically level. The maximum gradient, of which there is only one length of about 12 miles, is one per cent, or 52.8 feet per mile. The change between grades will be made by the ordinary vertical curve, but a very flat one, — one that will change from a straight line two inches in 400 feet. The railway is practically straight, the minimum radius being 20 miles. The line as laid down on the isthmus has curves of from 20 to 53 miles radius. At five points on the line, in order to avoid heavy mountain cuttings or very high embankments, a change of direction will be made by floating turntables, — a simple and economical device in first cost and operation, on which the vessels will be turned about while resting on a cushion of water. The whole line has been very carefully surveyed, and is practically located. Careful examinations have been made to ascertain the character of the foundations, both for the road-bed and for the masonry structures. The result of these examinations shows that there is no bad or even questionable ground anywhere between the two termini. The accompanying map shows the topography of the country and the route of the railway, the river to be navigated and the harbors on the two sides.

It will be seen from the foregoing that the vessel, when lifted out of the water, is really water-borne on a system of columns of water under pressure, and that, in the position given by this hydraulic system, she is transported across the isthmus. It will also be seen and appreciated by every person who is accustomed to travel on the ocean, that the strain to the vessel by the methods proposed can never be so great as that which she must undergo every time she goes to sea. E. L. Corthell.

THE WATER-SUPPLY OF BRESLAU.

The results of Hulwa's numerous examinations of the waters of Breslau made during the years 1876–81, and which, up to that time, had appeared only in fragmentary official reports hardly obtainable even by specialists, were brought together into a single paper on the occasion of the German health exhibition in 1882–83. This paper, recently published, is of great value to all interested in water-supply.

As far as the well-waters are concerned, the numerical results are given only in selections and averages, and are, indeed, mainly of local interest. The story is essentially the same as may be told of any compactly built city, especially of the older parts, where the same houses have been occupied for hundreds of years. Of a hundred and fifty wells examined, less than ten per cent furnished water really good enough to use, and only two or three water which was above all suspicion.

Since the year 1871, Breslau has enjoyed a supply of water from the river Oder. The works are situated above the city, and the water is subjected to a thorough filtration through beds of sand and gravel.

Beiträge zur schwemmkanalisation und wasserversorgung der stadt Breslau. Von Dr. Franz Hulwa. (Ergänzungshefte zum Centralblatt für allg. gesundheitspflege, I. ii. Bonn, 1884.)

From numerous examinations of the Oder water before and after filtration, Hulwa concludes, that, with the exception of occasional disturbances at times of high water, the impurities of the river-water are so far removed by the process of filtration as to furnish a drinking-water almost above suspicion. In order to remove the fine particles of clay which give to the water, in times of flood, an opalescent appearance which filtration will not remove, Hulwa recommended treating the water, before filtration, with alum in the proportion of from one to ten parts of alum to a hundred thousand parts of water (by weight), according to the degree of turbidity of the water. This use of alum, which is becoming very common on a smaller scale, has not been adopted at Breslau. At the time of Hulwa's examinations, the sewage of Breslau all ran into the Oder opposite and below the city, in anticipation of the completion of the sewage-farms now in use. The study of the effect of this discharge upon the stream is perhaps the most interesting part of the document. Although the volume of sewage is, on the average, only $\frac{1}{14\frac{1}{2}}$ of the volume of river-water, and in times of flood only $\frac{1}{67}$, the river opposite and just below the city gives abundant evidence of pollution, — pollution which becomes less and less marked as the stream flows. Thirty-two kilometres below the city neither chemical nor microscopical examination was able to show any evidence that the water was not quite as suitable for water-supply (after filtration) as the water from the same stream above the city at the present pumping-works. Hulwa is of the opinion that the natural purifying agencies are quite sufficient to take care of the amount of sewage which was then discharged into the river, and that, *a fortiori*, the effluent from the sewage-farms may be safely disposed of in that way. He is careful, however, to admit the possibility of overloading this or any other stream, and of calling upon the natural agencies to do more than they are capable of doing. He thus agrees with most experts who have studied this matter, that the discharge of sewage or other polluting matters into a stream is not to be decided in all cases by an absolute prohibition, but that the size of the stream, the proportion of polluting matters, and other circumstances, must be taken into consideration.

THE CONSUMPTIVE PERIOD.

HIPPOCRATES declared that consumption gathers the greatest number of victims between the ages of 25 and 35 years, and the same observation holds true to-day.

As a first and natural deduction from this fact, the opinion has obtained, that men are more susceptible to consumption between 20 and 35, and that, passing this period, they gradually acquire an immunity from the disease.

A more careful study of the statistics, however, reveals a fallacy in this reasoning. Hitherto it has been the custom to reckon the mortality of each period of life as a fraction of the entire mortality of all ages. By this method it is shown merely that during certain decades of life more individuals die of phthisis than during other decades. This amounts, however, simply to saying that within these periods of life a greater number of people are living. The total number of deaths from any disease, at any given age, must be greater or less, according to the number of people existing at that age; and a large proportion of mankind are from 20 to 35 years old. In order, therefore, to determine the individual risk of consumption at any specified time of life, it is necessary to know the whole number of persons living at that age, and then compute the percentage of them who die of consumption.

Figuring in this manner, Würzburg estimated the annual percentage of mortality from phthisis at different periods of life in Prussia, and he found the following table for every 10,000 persons living at each period: —

AGE.	MEN.	WOMEN.	AGE.	MEN.	WOMEN.
0–1	24.95	21.92	25–30	40.04	33.58
1–2	20.27	20.55	30–40	44.25	38.12
2–3	12.09	12.94	40–50	57.10	40.10
3–5	6.49	7.18	50–60	82.38	54.48
5–10	4.07	5.26	60–70	112.25	76.09
10–15	4.35	7.38	70–80	75.23	50.03
15–20	17.87	18.87	Over 80	31.71	21.01
20–25	34.77	25.93			

From this table it is seen that a large phthisis mortality prevails during the first year of life; thence it descends to a minimum between 5 and 15 years of age; from this point it increases with rapid strides, until, between 60 and 70 years, it reaches the high figures of 112.25 per every 10,000 living beings of that age: in other words, these figures mean that a man's liability to death by consumption increases from puberty till 70 years of age.

The companion column of the phthisis mortality of women shows that they are more frequent victims during childhood, but during the third decade and thereafter their relative liability is diminished.

These figures of Würzburg are confirmed in their main features by the investigations of Lehmann in Copenhagen, and of Schmitz in Bonn. Lehmann also extended his query to the relative duration of phthisis at different ages, and found that under 20 years of age more than 75% of phthisis patients die within a year. This rapid progress of the disease diminishes with increasing years until at least one-half of the cases terminating after 55 years of age present a record from three to many years' duration. It follows from this that a portion of the increased phthisis mortality of advanced years is due to cases which have lasted over from the earlier decades.

Die schwindsuchtssterblichkeit in den dänischen städten im verhältniss zu der lebenden bevölkerung in den verschiedenen altersklassen und geschlechtern. Von Dr. JULIUS LEHMANN. (Ergänzungshefte zum Centralbl. allg. gesundh., 18 p., pl. 8°. Bonn, 1884.)

Ueber den einfluss des geschlectes und des lebensalters auf die schwindsuchtssterblichkeit. Von Dr. JACOB SCHMITZ. Bonn, 1884.

THE BERLIN EXHIBITION OF HYGIENE IN 1882-83.

The committee having in charge the preparations for, and the direction of, the German exhibition of hygiene, decided wisely, it seems to us, to substitute for the usual premiums a scientific report upon all objects shown, and possessed of real merit. At the close of the exhibition in the autumn of 1883, the work of preparing this report was placed in the hands of Dr. Börner of Berlin. The first part of his report has recently been published, and is soon to be followed by a second and concluding volume. This report contains a number of papers upon topics of the greatest interest to students as well as to the interested general reader. Drs. Wolffhügel, Sell, Löffler, König, and Baginsky, among others, have contributed, each in his own field of work, articles that have all the value of special treatises upon the topics assigned to them.

This exhibition, which came into existence in consequence of the direct exertions of the Deutsches verein für öffentliche gesundheitspflege, was to have been opened in May, 1882. A fire, however, destroyed in a few hours the completed building and contents. A new and more secure structure, with a larger collection of articles, was ready in the following year, and was opened to the public on May 12, 1883, under the patronage of the Empress Augusta. This was not a display of new things only, but a very complete exhibition of what has been done, or is now doing, for the protection of human life. Many of the objects exhibited have been secured by the Prussian government as a foundation of a permanent museum of hygiene.

The author truly enough asserts that exact science is extending constantly its territory within the domain of hygiene, and then adds with equal satisfaction Prince Bismarck's official declaration that the best work of medical science lies, not in the curing of disease, but in the higher office of preventing it. A study of the German exhibition of 1883, and of that at London in 1884, shows once more that the Germans may fairly claim the leadership in the scientific investigation of questions that belong to hygiene, while to the English still belongs the credit for the technical execution that brings the results of these investigations to the protection of the public health.

Nothing in this exhibition attracted more notice than the pavilion of the Imperial health office, — a model building, containing a complete collection of the apparatus used in the investigations of the infectious diseases, and in the examination of articles of food. The relief plan of Berlin, prepared by Prof. H. Gruner for this exhibition, is another proof of the excellent work carried on in this city in the department of hygiene. The plan, in addition to the peculiarities of the surface of the ground, gives the soil in section to the ground-water level, making apparent to the eye the great difficulties in the way of a thorough system of drainage, now accomplished under G. Hobrecht's energetic direction. A visit to the very extensive and successfully managed irrigation fields of Berlin was an instructive addition to the plans and descriptions of this work shown at the exposition. In the years since the war of 1866, a very valuable work has been done in Berlin by an association of ladies, and largely under the direction of Frau Lina Morgenstern, in the people's kitchens, which are, in effect, schools for instruction in the proper and economical preparation of food. This was all well shown, together with a large collection of articles of food and drink in all stages of preparation, and also in all degrees of adulteration.

The best form of shoe is the subject of an instructive paper by Dr. F. Beely. The various forms of shoe tried in the German armies were exhibited, with indications of defects and merits, from the time of Professor Meyer's first publication at Zurich, in 1857, upon the proper shape of the shoe. The military authorities of Germany have made a careful study of the subject. The normal form finally adopted by them closely resembles a much-advertised English one.

Another public necessity, well represented in the exhibition, and made the subject of an exhaustive paper by Dr. Lassar, is that of baths and laundries. Among these stand easily first the public baths of Bremen, built in the years 1876–77, at an expense of a hundred and twenty-five thousand dollars, not including the cost of the land. A bath here, with all the conveniences of the best private house, may be had for twenty-five cents, while one provided with all that is really necessary can be had for six cents. It is not necessary to add, perhaps, that a large part of the capital was given.

Institutions for the care of the poor, prisons and reformatories, were well represented by plans, models, and statistical tables, notably the great prison at Plötzensee, containing at present a population of two thousand, and the workhouse at Rummelsburg, — both mod-

Bericht über die Allgemeine deutsche ausstellung auf dem gebiete der hygiene und des rettungswesen. Breslau, 1885. 8°.

els of their kind. Tenement houses and schools, as exhibited, present nothing of unusual interest. The first-named are distinctly inferior to the better English models.

This volume closes with a review by F. O. Kuhn, architect, in Berlin, of structures exhibited by plan, for the shelter of soldiers in times of peace. The most conspicuous example shown was the new caserne at Dresden, — a complex of buildings, containing shelter for seven thousand men. A characteristic feature of this caserne is the complete separation of the rooms for day use, sleeping, eating, washing, and working, — an arrangement from which the Saxon authorities already claim a marked improvement in the health of the inmates.

If Dr. Börner's second volume is as satisfactorily edited as this has been, the work will have a permanent place in the history of preventive medicine.

COMFORT AND LONGEVITY.

JOSEF KÖRÖSI is the director of the Bureau of statistics in Budapest, and he has apparently brought to his work a mind well adapted to the difficult task of handling figures in bulk. The essay which he presents to us under the above title was read in September last, before the Association of hygiene in Berlin, and in it he has confined himself to a few points only. He has endeavored to determine the influence which the varying pecuniary conditions of life, with their attendant privileges or privations, have upon the longevity of the people of his city. For convenience he recognizes four classes, according to their endowment in worldly goods; those who are very rich at one end of the category, and those who suffer from abject poverty at the other. Between these extremes lie the great mass of the people, whom he divides into the middle class and the ordinary poor.

He does not claim that his figures possess an absolute mathematical value, because he could not determine the number of living individuals in each category; but by excluding children under five years of age, and taking the average age of those dying during a period of eight years, he found that

The rich class averages	52 years of life.
The middle class averages	46 years 1.1 months of life.
The poor class averages	41 years 7 months of life.

From this it is obvious that the possession of wealth, and the resultant exemption from privation, lengthen the average life nearly ten years.

The second point which he studied was the relation existing between epidemic infectious diseases, and the pecuniary status of the different grades of the community. Upon this point he finds that poverty does not exercise a uniform influence upon the occurrence of these diseases: indeed, viewing them as a whole, the well-endowed, excepting the very richest, are more seriously afflicted than the poor.

Viewing the infectious diseases separately, he finds that cholera, small-pox, measles, and typhus are more prevalent among the poor, while diphtheria, croup, whooping-cough, and scarlet-fever are more prevalent among the rich. Consumption and pneumonia claim the poor, and brain-troubles attack the rich.

In view of legislative action regarding the abodes of the poor, Körösi next studied the influence of basement tenements upon the occurrence of epidemics; and he found, that, taking the infectious diseases as a whole, they are 60% more frequent in the cellar than in the elevated tenements.

The cellar residence, however, does not favor all diseases alike. Measles and whooping-cough are very prevalent there, croup less so, while diphtheria and scarlet-fever are 10% less frequent among cellar inhabitants than among those more loftily housed. This is in accordance with statistics from other places, and notably from Boston, where epidemics of diphtheria have swept over the finest parts of the city, and have left the low sections and cellar regions almost exempt.

Lastly, Körösi considers the influence of crowding upon epidemics. To obtain a standard, he noted the number of rooms in each house, and the number of people occupying them. Combining these figures, he obtained the average number of persons per room. A possession of one or two persons to each room was taken as normal, while three, four, and five persons per room were considered overcrowding. He found that the intensity of some infectious diseases was notably increased in the crowded tenements. This increase amounted to 364% for measles in houses inhabited by more than five persons per room. Whooping-cough is likewise greatly intensified by crowding. On the other hand, it does not appear that scarlet-fever and diphtheria are similarly favored by the increased number of people in the house. These are rather surprising conclusions, and may find their explanation when we discover the manner in which these various diseases are transmitted from person to person.

Ueber den einfluss der wohlhabenheit und der wohnverhältnisse auf sterblichkeit und todesursachen. Von JOSEF KÖRÖSI. Stuttgart, *Enke*, 1885. 8°.

ANIMAL DISEASES AND PUBLIC HEALTH.

The object of this book is to introduce to the people of this country 'the higher purposes of veterinary medicine.' These higher purposes are the better protection of the public health, and the mitigation of certain evils relating to our food-supply.

The amount of capital invested in live-stock is enormous, and the animal product a most important part of our national resources. The better protection of this property from disease is discussed in the third part of the book. Writers have usually treated this material or pecuniary side as the more important aim of veterinary medicine: it is here, however, discussed as secondary to that of public sanitation. In part second the author gives an excellent history of veterinary medicine, and of veterinary schools in Europe, along with much information not easily accessible elsewhere.

This age of steam has in many ways stimulated the production of live-stock; and the relative proportion of animal to vegetable food has of late years been rapidly growing. This is in part due to the fact that the art of stock-breeding has greatly advanced, and in part to the modern facilities for the preservation and transportation of animals or their products. While this is, as a whole, doubtless a benefit to mankind, it has at the same time enormously increased certain dangers to public health. Old dangers have increased, and new ones been introduced that our fathers knew nothing of. Moreover, modern scientific investigation has traced to our domestic animals certain diseases of man the origin of which has heretofore been a mystery; and we now know that the public health is related to that of our domestic animals in more ways than the public yet appreciate.

Dr. Billings has therefore an important theme, and he tells his readers 'not to forget that the author is an enthusiast;' and we will add, that, like many enthusiasts, he advocates measures for the details of which, even if practicable, the public are by no means yet ready. Indeed, like the public, the author himself devotes the most attention to some of those dangers which are by no means the greatest, if we measure their results by mortuary statistics.

That the flesh of obviously diseased animals is unwholesome food for man, has been the common belief for ages; and communities that have any public markets at all have generally placed legal restraints on its sale. In most civilized countries, there are severe penalties for selling diseased flesh of certain kinds; but in our country the administration of sanitary laws in this direction is very defective, and the methods very faulty. In some directions there is, as yet, no official or organized effort to meet dangers the existence of which is reasonably well demonstrated.

We may say, in a general way, that the health of the people is directly related to that of their domestic animals in at least five ways. In the first place, some of their contagious diseases are directly transmissible to us, and are very fatal; and to this class belong some of the most dreaded of diseases. For example: in proportion to the relative number of its victims, hydrophobia inspires more terror than any other disease known to us, and greater exertions are made against it than against any other one disease which slays so small a proportion of the population. This, in man, comes only from animals. In the same category we may place anthrax and glanders, both very fatal. The foot-and-mouth disease of cattle, transmitted to man through the milk of diseased cows, is less fatal, perhaps, but still too troublesome, and unfortunately too common, to ignore, and others of less note are well known. The mortality in any community, due directly to this class of diseases, is relatively small; yet there is a positive danger, against which we have as yet inadequate protection, and where we especially need intelligent official action founded on proper veterinary authority.

Closely related to this is a class of diseases less contagious, and where the direct transmission to man does not so commonly follow exposure, or where, at least, the demonstration is as yet incomplete; where we can say that the public health may, and probably does, suffer, but where the proof is lacking, and the extent of the danger very uncertain. Such is the case with tuberculosis. That tuberculosis of cattle is very common in the old world, that it is less common here but is increasing, all who have studied it believe. That tuberculosis in man is in a degree transmissible, is, we think, now generally conceded; and that tuberculosis in cattle may be transmitted to other animals through the milk of tuberculous cows is proved. That it is transmitted from cattle to man through milk is not proved, but the analogies are most suspicious, and have of late attracted much attention. The author gives an excellent history of the investigation in Germany, and gives suggestive statistics of the extent of the disease among European cattle.

The relation of animal diseases to the public health, and their prevention. By Frank S. Billings, D.V.S. New York, 1884.

In the light of our present knowledge, few intelligent parents would knowingly allow their children to use the milk of tuberculous cows; but as yet we are powerless to prevent its sale in our cities.

A third class of diseases grows out of animal parasites in the flesh of the animals we use as food. Of these, trichiniasis has of late played the most sensational *rôle*. For the last few years this has been prominently before the public; but in our own country, curiously enough, our officials, because of commercial complications, have tried to hide the danger, rather than guard against it. Outside of the advertisements of quack medicines, no more astonishing sanitary literature can be found than some of the public, not to say official, utterances regarding trichinae in the swine of this country. Our author gives numerous statistics, both from other sources and from original investigations, which show that the disease is common enough and wide-spread enough to need more careful watching. Fortunately, each household can protect itself from this class of diseases by thorough cooking; but, considering the customs of cookery, there should be other protection. Tape-worm belongs in this class of diseases. We think that the author overrates the danger from the Taenia medio-canellata derived from beef (more probably from veal?), and quotes Thudicum of twenty years ago to show that the rarity of the cysticercus in beef makes it more dangerous, — a doctrine from which we entirely dissent. In this country the vast majority of tape-worms appears to be the T. solium which we get from 'measley' pork.

There is still another way in which the flesh of diseased animals probably affects the public health. Animals are subject to certain diseases which affect their flesh, but which are not, so far as known, transmitted to man. The so-called hog-cholera is such a disease; yet experience has shown the propriety of forbidding the sale of the pork in the markets when sufficiently affected to have the red spots.

The author advocates much more extensive inspection of animals, but we fear that his zeal has led him to impracticable lengths. When we consider the enormous number of animals slaughtered by the producers of the same on their own farms, and the production of milk on small farms not called 'dairy' farms, we fear that a system of inspection which will extend to 'all animals slaughtered,' and to all the cows on all the farms which may supply milk for sale, is impracticable. Nor would he, we think, have written that '*city inspection* [of milk] *is next to useless*,' if he had had any experience in official sanitation in a large city, drawing its milk-supply from regions over which its officers had no jurisdiction whatever. Because we cannot have the most perfect means of protection, it is nonsense to decry the only means that are available, and which, experience shows, make a great improvement in affairs. And, however necessary and important official inspection may be, one cannot hope for 'the unquestionable guaranteeing' of safety by any official board: that is asking a great deal.

His short chapter on hippophagy, as practised in Europe, is both interesting and opportune. The growing consumption of this cheap, nutritious, and wholesome meat is a good thing, which the next generation will doubtless find common in all enlightened countries. The poorest chapter in the book is that relating to infection and bacteria, some portions of which (and notably the botanic portion) are lame. But the book is an important one: it deals with an important subject, and is the repository of much useful information in an interesting and available shape.

HOUSE-DRAINAGE.

Of the numerous books which have appeared during the past year, devoted to this subject, many are too exclusively taken up with the plumbing and drainage of houses and tenements in cities and towns provided with sewerage systems. In Col. Waring's book, entitled 'How to drain a house,' the individual householder, to whom the volume is chiefly addressed, will find valuable counsel, whether his domicile is in a crowded city, or in a country or suburban village where connection with public sewers is impossible.

The great value to the state, of sanitary works, such as pure water-supplies and the proper drainage for the removal of sewage, has been successfully demonstrated, and the same principle is none the less true of each individual dwelling.

The first and principal portion of the book treats mainly of that portion of the drainage system which is included within the interior of the house. The closing two chapters are devoted to the disposal of the sewage of isolated houses, and the special method of sub-surface irrigation.

The style is concise, and the illustrations are clear and simple, and shorn of all unnecessary

How to drain a house. Practical information for householders. By GEORGE E. WARING, Jun., M. Inst. C.E. New York, *Holt*, 1885. 222 p. 12°.

details. The reader is not left to lose his way among a bewildering array of traps, vents, and fixtures of every possible variety of style and shape. The writer addresses these chapters, not to plumbers, architects, or engineers, but, as he says, to "the limited class who are willing to learn, and with whom a promising suggestion becomes a fruitful germ; to the few who will agree with their teachings; and to the more who will take their propositions into earnest consideration, without the intention, and often without the result, of agreeing with them."

If the wise counsel offered in this volume were generally complied with, diphtheria, typhoid, and other filth-diseases would undoubtedly be reduced to a minimum, and the death-rate would show a corresponding improvement.

NOTES AND NEWS.

If the air carries infectious germs, it certainly would be well to filter it before inhaling. We reproduce from *Science et nature* a cut showing a French physician of the time of the pestilence of Marseilles (1720–21) on his round of visits. He is incased in an armor consisting of a short morocco gown, a helmet of the same material, and a nose stuffed with aromatics, which, notwithstanding its being a doctor's nose, would prove an enlivening feature at a carnival. Did the doctors touch their patients only with the end of a stick? The illustration seems to indicate as much.

A FRENCH DOCTOR OF THE OLD SCHOOL.

—The conductor of the Cartographic institute, Hamburg, Herr L. Friedrichsen, writes thus concerning the limits of the German possessions in West Africa: "The Mahin district on the Gulf of Benin, between Lagos and the mouth of the Niger, settled by the Hamburg firm of G. L. Gaiser, has not yet been placed under German protection. The coast from Jaboo to Old Calabar will, in my opinion, be in future regarded as under British protection, but has not hitherto been officially placed under any European power. The frontier of the German Cameroon begins with the Ethiopian cataract on the Great River lying from there in a south-westerly direction, to the sources of the Rio del Rey, following the right bank of this river to the coast, then the coast-line in a south-easterly direction to the river Behuwe, excluding the town and neighborhood of Victoria as British, as well as the island of Malimba. The latter, as well as the whole coast from the river Behuwe to Gumbegumbe, is not described by me in the commissions of foreign officials as without a ruler, but as a tract on which the actual raising of the German flag is yet the subject of diplomatic treaty. The German protectorate in south-west Africa begins with 18° south latitude, not with Cape Frio."

—Prior to 1850, there were no effectual laws in England to regulate the number of hours of work per day for children and women: consequently they were in many places obliged to work from fifteen to sixteen hours daily. Certain laws had been passed, but they were so loosely drawn up that they were easily evaded. After 1850, practical laws were passed at frequent intervals, to protect the people in various kinds of industry, and ten hours and a half were made the extreme limit of work. A. Ollendorff has studied the mortality statistics of England for a series of years before and after 1850, and he finds that the mortality of women and children in manufacturing towns has notably diminished since these protective laws came in force.

—The *Oil trade review* reports that rich petroleum grounds have been found at Deli, on the east coast of Sumatra. After experimental borings, a well was found at a depth of thirty metres, which yields about three hundred and sixty gallons in an hour. When the last layer of earth was pierced, the oil rose in a strong volume to a height of two metres out of the bore.

—Reichemberg's system of employing the same wire for telegraphing and for the use of the telephone simultaneously, has been tried with great success between Toledo and Madrid.

—A committee has been formed in Stendal to put up a monument of the late Dr. Gustav Nachtigall, the African explorer and general consul so recently dead.

SCIENCE.

FRIDAY, JULY 17, 1885.

COMMENT AND CRITICISM.

AN APPROPRIATION of fifty thousand dollars was granted by the legislature of Pennsylvania, at its late session, to continue the state geological survey for 1885 and 1886, and the governor has signed the bill. The board of commissioners of the survey asked for ninety-two thousand dollars, to which the senate agreed; but it was reduced by the house to the above sum. It will be expended chiefly on the anthracite regions. A final report by Prof. J. P. Lesley will close the series of reports, giving, in a condensed form, a summary of the whole, — a most difficult but exceedingly useful and popular volume.

The legislature made short work of the difficult and troublesome question of how the large accumulation of printed reports of the survey shall be disposed of, by voting the books to themselves. They reduced the number to be hereafter printed, and disposed of them in practically the same way; reserving, however, a sufficient number for distribution to public libraries, colleges, and for exchange with other states and countries. The system of selling the reports has been abolished, as the large number of gratuitous copies interfered with the sales. The large number of small volumes of these reports, and the manner in which they will be scattered broadcast through the state, will soon render it difficult to collect a perfect set; but the great size of the edition will always make them cheap.

THE FAITH OF THE EARLIER geologists, that the whole earth was built according to the European pattern, has received in other parts of the world many severe contradictions, of which our country has furnished a good share. Years ago, the thousands of feet of Appalachian sediments, and the undisturbed position of the typical New-York series, ran counter to beliefs prevalent at that time in England and on the continent; and later explorations have continued the process of broadening our geological understanding by bringing to light one example after another of structures and occurrences that violate the European precedents. The 'great break' between paleozoic and mesozoic formations is passed over quietly in the Rocky-Mountain region by a mighty series of strata following conformably from Cambrian to cretaceous. The Laramie controversy began, in good part, in the belief that the deposits in question must be either cretaceous or tertiary, and could not be neither or both. And in paleontology our many-toed horses, if the diminutive quadrupeds deserve that name, and the sharp-toothed birds, if those strange-winged creatures may be so called, confirm the change from Cuvier's teachings to Darwin's.

In structural geology the contradictions are as marked. The old dispute concerning craters of elevation has new and unexpected light thrown on it in the local upheavals of the Henry Mountains, where lateral intrusions of lava blister up the overlying strata. At a time when the theory of direct vertical elevation by underlift was going out of fashion in some quarters, the enormous upheaval discovered in the horizontal rocks of the Colorado plateaus restored it to a firmer place than it ever had. The theory of the ice-cap, or, in other words, the idea that areas of glaciation were limited southward by latitude lines, found its first serious check in the absence of every thing but local ice-action among our Cordilleras, due west of a much lower region that had been heavily glaciated. The attitude of faults that is 'normal' in some countries is directly abnor-

mal in others, and the name is an unhappy misnomer.

Finally, the rule stated in the latest English text-book of geology, that faults give rise to little or no topographic feature, so that their existence would commonly not be suspected, is conspicuously violated in the northern part of the Great Basin, over an area about as large as England. In this region, as well as in others of similar structure farther south, the faults break through all formations, including the recent; and the heaved masses stand up, bordered by abrupt cliffs that have not retreated perceptibly from the line of fracture. The depressions among the tilted blocks are occupied by numerous lakes, which are thus, in respect to origin, as novel as the distinct forms of the faults themselves; for, among the thousands of lakes in other parts of the world, it is difficult to name half a dozen examples whose origin is so directly due to this kind of displacement.

Visitors to Switzerland in the last twenty years have seen one characteristic part of that charming country at a disadvantage. The glaciers that the guides or their fathers remember seeing well advanced into the valleys have been found greatly reduced in size, shrinking back a thousand feet or more from their fresh-looking moraines, and uncovering broad surfaces of bare rock and gray rubbish, not attractive to the general visitor, however interesting they may be for the glacialist. The little huts built a few years ago at the foot of the ice, for the reception of tourists, have been left quite out of place, as the ice melted away uphill behind them. Now the good news arrives that a good number of glaciers have come to a halt in their retreat, and that for two or three years an advance has been observed. This is well for our children, who may now see the glaciers in good size again in ten or twenty years, if the advance is as persistent as the retreat that preceded it.

LETTERS TO THE EDITOR.

The sculptures of Cozumalhuapa.

The suggestion in *Science* (vol. v. p. 524) that the shell-carvings figured by Mr. Holmes in the last report of the bureau of ethnology may indicate a common origin with those of Cozumalhuapa, will naturally lead to the inquiry, What branch of the American race executed the latter?

Unfortunately this is not easily answered. Perhaps we may proceed most safely by the method of exclusion. When Cozumal was discovered, three entirely dissimilar stocks occupied the immediate vicinity. The locality itself was held by the Cakchiquels. According to their annals, as preserved by the native chronicler, Francisco Ernantez Arana Xahila, they had occupied that territory but shortly before the Spanish conquest, driving out either the Xincas or the Pipiles, both of whom continued to live at no great distance. The Pipiles were a Nahuatl-speaking colony, of the same blood and language as the Aztecs, and were skilled in the same arts. The Xincas, on the contrary, were a savage people, whose culture-words were borrowed from either the Pipil or the Cakchiquel tongues. They may therefore be excluded.

The Cakchiquels were one of four tribes closely allied in language, culture, government, and geographical position; the others being the Quiches, the Tzutuhils, and the Akahals. They were familiar with picture-writing, stone-cutting, the metallurgy of gold, silver, and copper; erected massive buildings of stone and mortar; and were adepts in carving designs and weaving cloth. They certainly had the technical ability to execute such work as that on the slabs of Cozumal; but what is lacking, is evidence that it is in the style of their art. It differs very widely from that of Palenque and Copan.

The deficiency here pointed out is one most desirable to have filled. The vicinity of Iximche and Gumarcaah, the ancient capitals of the Cakchiquel and Quiche nations, might still yield a harvest to the persevering archeologist, in spite of the reports of Mr. Stephens. The Archbishop Garcia Pelaez, writing in 1850, stated that the government of Guatemala had 'recently' caused a careful survey, with maps and drawings, to be made of these remains (*Memorias para la Historia de Guatemala*, tom. i. p. 15); but I cannot learn that these were ever published, nor have my correspondents in Guatemala been able to ascertain the whereabouts of the originals. I may also add, that I have endeavored in vain to find out what became of the manuscripts left by Dr. Habel, the discoverer of the remains at Cozumal. Many of his notes had not been published, and it is quite possible that they would throw further light on this interesting question.

D. G. Brinton.

Media, Penn., July 2.

The geology of natural gas.

Prof. I. C. White's article on the geology of natural gas (*Science*, June 26) must necessarily attract no little attention from those who have never been in the oil and gas regions of south-western New York, western Pennsylvania, and eastern Ohio, where these wonderful and natural products are obtained; and also from those who are familiar with its commercial value and usefulness, but who have never made a study of the geological phenomena connected with its occurrence. In fact, the geology of this interesting region is so imperfectly understood by some of our leading professional geologists, who have never had

an opportunity to investigate in the field all the geological conditions under which petroleum and natural gas are found, that I fear Professor White's necessarily brief article, based upon his field studies, will mislead many.

Although it is to be regretted that no general work "has been published on the subject which would prove of any value to those engaged in prospecting for natural gas," yet Mr. John F. Carll, geologist in charge of the survey of the oil regions, and myself, among others, have collected a vast amount of information on the subject to elucidate many of the intricate questions connected with the exploration of natural gas.

Professor White's theory, that 'all great gas-wells are found on the anticlinal axes,' cannot be accepted until he shall limit, by definition, all great gas-wells to exclude all gas-wells, both large and small, comparatively, which produce gas from strata not found either on anticlinal axes or in close proximity to such structural lines. The Kane gas-wells, the Ridgeway well, the 'Old Mullin snorter,' and several Bolivar wells, are notable instances among many which might be mentioned where large gas-wells have been drilled in or near the centre of synclines.

Although it is a fact that many of our largest Pennsylvania gas-wells are located near anticlinal axes, yet the position in which gas may be found, and the amount to be obtained, depend upon (*a*) the porosity and homogeneousness of the sandstone which serves as a reservoir to hold the gas; (*b*) the extent to which the strata above or below the gas-sand are cracked; (*c*) the dip of the gas-sand, and the position of the anticlines and synclines; (*d*) the relative proportions of water, oil, and gas contained in the sand; and (*e*) the pressure under which the gas exists before being tapped by wells.

All oil-bearing sandstones contain a greater or less quantity of gas; and most gas-producing sandstones contain some oil, although a number of wells said to produce 'dry gas,' or that in which no oil or water can be detected, contain gas to the exclusion of fresh water, salt water, or oil.

Many facts could be cited which would disprove or render insufficient Professor White's 'three or four general rules' connected with the occurrence of natural gas in Pennsylvania formulated on the basis of his theory. This theory, in many cases, apparently explains the occurrence of gas; and what have proved large gas-wells have been located on anticlinals; but the theory, as a practical basis of successful operations generally, has no more claims as a final statement than 'Angell's belt theory,' which accounted for the occurrence of petroleum, as understood by him in 1867, when his theory was first announced. Many successful oil operations have been based on the 'belt theory,' and fortunes made; but it has long since been found to be insufficient to account for the existence of petroleum in all the Pennsylvania districts.

CHAS. A. ASHBURNER,
Assistant geologist Penn. surv.
907 Walnut Street, Philadelphia,
July 1.

In reply to Mr. Ashburner's criticism of the views advanced in my article on natural gas, I would say that the necessary brevity of the paper in question prevented the mention of many facts that might have rendered the conclusions clearer, and less open to challenge. One of these is, that my communication had especial reference to the natural-gas regions proper; i.e., where the gas is unconnected with oil-fields. Most geologists know that natural gas in large quantity exists with, and contiguous to, every oil-pool, apparently as a by-product in the generation of the oil; and of course the rocks are filled with it wherever it can find a reservoir. To gas-wells from such sources Mr. Ashburner's criticism may sometimes be found applicable; but, even with these, by far the larger ones will be found on the arches of the rocks.

The cases that Mr. Ashburner mentions, where large gas-wells have been found at the centre of synclines, do not necessarily contradict my conclusions; for no one knows better than he that a subordinate crumple or anticlinal roll often runs along the central line of a syncline. Messrs. Ashburner and Carll have indeed collected and published many well records, and other data concerning oil and gas, that are invaluable with reference to the contiguous oil and gas regions already developed; but, if they have written any thing that would prove a guide to one in search of new gas-fields, the writer has failed to get access to the same.

My excuse for writing the article on natural gas was that I might be of some service in preventing the waste of capital that has been going on within a radius of fifty miles from Pittsburgh by an indiscriminate search for natural gas; and it is a sufficient answer to Mr. Ashburner's criticism to point him to the brilliant lights along the crests of the Waynesburg, Pin-Hook, Washington, Bull-Creek, Brady's-Bend, Hickory, Wellsburg, Raccoon, and other anticlinals, and also to the darkness that envelops the intervening synclines, in which hundreds of thousands of dollars have been invested without developing a single profitable gas-well. The same result has been proven in other portions of the country. The Great Kanawha valley above Charleston has been honeycombed with borings for salt, and the only gas-wells developed were found within a belt a few rods wide, which coincides with the crest of the Brownstown anticlinal, where immense flows were struck. In this connection, I should state that Col. Allen of Charleston says he can trace the Brownstown anticlinal by the escaping gas across streams, and even mountains, from the Kanawha River to the Big Sandy, where, on its crest, near Warfield, two of the largest gas-wells ever known have recently been struck. At Burning Springs, on the Little Kanawha, the only large gas-wells were found on the very crest of the great uplift in that region. The gas-belt of western Ohio, through Findlay and other towns, follows closely the line of the Cincinnati arch; and the same story is repeated in other localities too numerous to mention.

Mr. Ashburner can, if he chooses, interpret these facts as mere coincidences, and explain them to himself as having no more bearing on the question of finding gas than 'Angell's belt theory' of oil; but the practical gas-operator can no longer be deluded by such logic into risking his money in water-holes (synclines) where so many thousands have been hopelessly squandered.

With regard to the anticlinal theory not being 'a practical basis for successful operations,' I deem it a sufficient reply to state that all the successful gas companies of western Pennsylvania and West Virginia are getting their gas from the crests of anticlinal axes, while those that have confined their operations to synclines have met with uniform financial disaster.

The statement was distinctly made in my original communication, that gas would not be found on all anticlinals, nor at all localities along one that actually

produces gas, since other factors have to be considered, as there stated; but, with the facts before us, it would certainly prove a great saving of capital in the search for gas, if operations were confined to the crests of the anticlinals; and I fail to perceive how Mr. Ashburner's fears for the 'misleading' character of my article can be realized. I. C. White.

Mountain-Lake Park, Md., July 11.

A rare dolphin.

On the 3d of June the national museum received from Messrs. Warren & Co., fish-dealers in Pensacola, Fla., a very beautiful and highly interesting dolphin, which was captured in the Gulf of Mexico. The upper surfaces of the body were dark slate-color, sprinkled with whitish spots about the size of a cent; while the under surfaces were white, spotted with dark gray. The species belongs to the genus Prodelphinus, — a genus closely allied to Delphinus, of which the dolphin of the ancients, D. delphis, is the type. Numerous species of Prodelphinus have been described from single skulls, but scarcely any thing is known regarding their external forms or relationships. The recent discovery of great schools of this spotted species in the Gulf of Mexico, and also, still more recently, by the U. S. fish-commission steamer Albatross, off the coast of North Carolina, gives the hope that we may soon be able to clear away the obscurity now resting upon the genus.

F. W. True.

U. S. national museum.

The scenery of Arizona.

The unique character of western Arizona leads me to add a few words to the article of 'A. G.' in your issue of June 26. Only ignorance of the extreme attractiveness of this almost unexplored region explains the fact that so few tourists find their way thither.

My chief object in addressing you is to mention an easily made excursion from Flagstaff, fifty miles to the south, through Oak-Creek valley, and into the valley of Beaver Creek, to Fort Verde. Oak Creek is more like a White-Mountain stream than any other creek that I have seen in Arizona. The valley broadens to a considerable width, after dropping down a thousand feet or more from the mesa upon which the creek rises, and is enclosed by lofty bluffs of sandstone, the lower half of which is deep red, while the upper half is bright gray. The line of demarcation between these colors is remarkably distinct. These rocks, of mesozoic age, have been sculptured by eroding waters in the most wonderful manner.

This region is easily explored by following the trails on horseback. The rocks have not, of course, the sharpness and steepness of limestone mountains (the Alps, for instance); but it has never been my lot to view scenery elsewhere so graceful and picturesque. I feel at liberty to speak with enthusiasm on this subject, for none that visit Oak-Creek valley will come away disappointed. R. Spaulding.

Montclair, N.J., July 4.

The classification and paleontology of the U. S. tertiary deposits.

Although much tempted to make some comments on the remarkable statements of Dr. Otto Meyer relative to the south-western tertiaries, in his late article in the *American journal of science*, I had determined to keep silence until the second part of his work, presumed to contain the stratigraphical evidence he might have to present, should have appeared. In view, however, of Heilprin's notice of the subject in the issue of *Science* of June 12, I desire to enter a *caveat* on both sides of the question, as one who has spent eighteen years, more or less, in the study of these formations. I emphatically agree with Heilprin as to the impossibility of subverting the cumulative stratigraphical evidence to the effect that the relative superposition of the several principal stages — the Burstone, Claiborne, Jackson, and Vicksburg groups — cannot be otherwise than as heretofore ascertained in hundreds of localities, by others as well as by myself; even supposing that the geographical distribution, with relation to the progressive elevation of the continent, could leave any doubt in the premises. I recall to mind that years ago I had occasion to repel a similar attempt, on the part of Mr. Conrad, to subvert the relative position of the Jackson and Vicksburg groups upon supposed paleontological evidence (see 'Remarks on the Shell Bluff group of Mr. Conrad,' in *American journal of science*, 1867). As Dr. Meyer seems to have been on the spot, and must have seen the Jackson strata disappearing beneath those of the Vicksburg group (if he ever descended Pearl River below Jackson), and the Claiborne and Jackson vanishing beneath the same and the Grand Gulf rocks (if he descended the Chickasawhay River), apart from what is proven by the exposures on the Tombigbee and Alabama rivers in the state of Alabama, his prediction that 'probably' the whole series might have to be turned upside down, is strongly suggestive of the periodic attempts to subvert the 'Copernican system' of astronomy.

Aside, however, from Dr. Meyer's stratigraphical vagary, I strongly sympathize with his views in respect to the transition of so-called species, mostly named by Conrad, from one of the stages to another; I repeatedly called Conrad's attention to the impossibility of maintaining a number of his distinctions, especially among the genera Pleurotoma, Fusus, Voluta, Corbula, Venericardia, and others; and finally, finding that every variation, clearly apparent to me as such, was by him interpreted as a new species, I ceased to send him fossils from the south-western formations, in order not to swell uselessly the already long list of spurious species. In a number of cases Dr. Meyer has observed and recorded precisely what I have long known to be the fact, — that oftentimes from two to five of Conrad's species are mere variations, easily recognized as such when the rich material is seen on the spot and in numerous localities. That Dr. Meyer has in all cases judged correctly, I am of course unprepared to say; but I emphatically hope that a critical revision of the tertiary and upper cretaceous fauna of the south-west will soon be made, with a view to what we have learned on the subject of evolution since Lea's and Conrad's time, and that the host of varieties now cumbering our tertiary check-lists in the guise of species will be reduced to something like a comprehensive view by a master hand. I doubt if there exists a finer opportunity for observing the evolution of marine species in tertiary times than is presented by the minutely differentiated formations of Mississippi and Louisiana.

E. W. Hilgard.

Berkeley, Cal., June 22.

The ginkgo-tree.

A large and remarkably fine specimen of Salisburia adiantifolia was in fruit on the Landreth estate, near Bristol, Penn., during September last, — an annual and by no means uncommon occurrence, according to the proprietors. Winthrop E. Stone.

Mass. ag'l exp't station, July 6.

THE TYNDALL FELLOWSHIPS.

AT the close of Professor Tyndall's brilliant tour as a lecturer on physics in various cities of this country during the winter of 1872–73, he devoted with unparalleled generosity the net results of all that he had earned to the encouragement of studies in physical science among young Americans. The amount thus set apart was somewhat more than thirteen thousand dollars ($13,033.34), and it was given to three trustees, — Professor Henry of Washington; the founder's kinsman, Gen. Hector Tyndall of Philadelphia; and Dr. E. L. Youmans of New York. After the death of the first two named, President F. A. P. Barnard and Professor Lovering succeeded to the vacant places. In the deed of trust, which is dated Feb. 7, 1873, and may readily be found in the Smithsonian report for 1872 (p. 104), the giver declared his purpose to be the advancement of theoretic science, and the promotion of original research, especially in the department of physics. The method of employing the fund which he then proposed was to assist in supporting, at such European universities as they might consider most desirable, two American pupils who might evince decided talent in physics, and who might express a determination to devote their lives to this work. He added that it would be his desire to have each scholar spend four years at a German university, — three devoted to the acquisition of knowledge, and the fourth to original investigation.

For some reasons not publicly explained, and not difficult to conjecture, the trustees have been embarrassed in trying to carry out the precise wishes of Professor Tyndall; and consequently but a very small part of the income of his fund has been directed toward the assistance of young physicists. One of those who received encouragement from the fund generously returned to the trustees the sum advanced to him; another to whom the benefit of the scholarship was offered hesitated about pledging himself to remain four years in Europe, and declined the honor of an appointment. Meanwhile the opportunities for studying physics in this country have rapidly improved. Excellent investigators in several universities have been provided with admirable laboratories, and with all the requisite apparatus for research. It is true that the opportunity to go abroad for a brief sojourn is still highly prized by our young men; but, if associated with an implied obligation to remain in Germany during four years, the value of the opportunity is seriously impaired. Meanwhile the trustees have been careful in the management of their fund, and, having added the unexpended income to the principal, are able to report that the original thirteen thousand dollars have grown to thirty-two thousand dollars, — a remarkable record in these days of financial shrinkage.

Fortunately the donor of the fund is still living, and has been able to modify the original conditions of his gift. At the recent commencement of Harvard college, President Eliot announced that Professor Tyndall gave to Harvard one-third of the accumulated fund, another third to Columbia college, and the remainder to the University of Pennsylvania. The income is to be devoted to the maintenance by each institution of a graduate scholarship or fellowship in the department of physics.

Under these new conditions, the original purpose of this generous gift is sure to be accomplished. By the maintenance of a wise system of appointments, such as the experience of these three colleges will certainly devise, the hope of winning a Tyndall prize will prove a strong incentive to young American physicists. The foundation will have an influence upon scientific studies akin to that exerted upon classical studies for many generations by the prizes of Bishop Berkeley. It is also interesting to remember, that, as the name of Rumford, an American physicist, is associated indissolubly with the Royal institution of Great Britain, where Tyndall holds the commanding station, so the name of an English physicist, Tyndall, will always be remembered with gratitude in the land of Rumford's birth, for kindred generosity in the encouragement of kindred pursuits.

THE LATEST VOLCANIC ERUPTION IN THE UNITED STATES.

In one of the volumes of the Proceedings of the California academy of sciences, Dr. H. W. Harkness describes the cinder-cone and lava-field at Feather Lake, Plumas county, Cal. Writing as I do in the field, and without access to books, I am unable to cite more accurately the description referred to. Dr. Harkness speaks of this volcano as being extremely recent, and mentions the fact that trees killed and half burned by the lava were still standing. Mr. John B. Trask also refers to it, with the statement that the eruption occurred in January, 1850; but he does not, so far as I recall, state the source of his information. I regret that I am obliged to depend upon memory alone in referring to these accounts of the outbreak. Within the last week I have had the pleasure of visiting Feather Lake in company with Mr. J. S. Diller, and can fully confirm Dr. Harkness's account of it, and feel confident that Trask's date, January, 1850, is quite in harmony with all appearances.

Feather Lake, prior to the eruption, was a sheet of water about four or five miles long, lying ten miles east-north-east of Lassen's Peak, say, in latitude 40° 34′, and longitude 121° 19′; and its altitude is about 5,800 feet above the sea. The vent now covered by a large cinder-cone is situated a little above the western shore. From it there flowed a very thick sheet of basaltic lava, which nearly filled up the lake-basin. The thickness of the flow considerably exceeds 100 feet, and may be as great as 150 feet on the average. The lava-field is about three miles and one-fourth in length, and a mile in width, and half environs the base of the cinder-cone. The cone itself is nearly 600 feet high, and the diameter at the base is about 3,300 feet. It is perfect in form, with a crater in the summit which is not broken down on any side. It is built of scoria and lapilli, the outer layers of which are like coarse sand, giving a smoothness and finish to the surface of the cone which I have seldom seen equalled. Great quantities of fine lapilli and 'ashes' are spread out over the adjoining country to a distance of two miles, and over the lava-sheet itself, quite burying it in some places. The impression of recency is conveyed by every aspect of the cone, of the lava-flow, and of the country round about. The rains have not, as yet, produced even the first trace of a water-channel upon the wonderfully smooth surface of the cone; and the only vegetation which has taken root is a single bush of Ceanothus, near the summit. The lava-sheet is rough and jagged in the extreme, but shows, as yet, no trace of weathering. For a space of four to five hundred yards from the cone, the trees were all killed. Most of them have fallen, and their decayed trunks are still lying on the ground, showing the marks of fire. In thirty-five years (the period assigned by Trask) such decay would be natural. Trees of the same species, felled certainly since 1850, show elsewhere in the vicinity an equally advanced stage of decay.

Whether the date assigned by Trask be the true one or not, the real date cannot be materially older. That the eruption was not at the time a matter of common fame, is readily intelligible; for the settlement of the northern part of the state did not begin until a year or two afterwards, and it is not probable that any observers except Indians could have witnessed it. Harkness adds, I believe, that it was still hot and feebly 'smoking' in 1852. This may be quite true; for the lava-sheet is an exceptionally thick one, and may have preserved its heat for a long time. And it may also have been seen by many white men in that year; for one of the routes by which overland emigrants poured into the state was laid in that year along the very base of the cone, and is known to this day as the 'Emigrant trail.'

I am not aware of any volcanic eruption in the United States which is so recent as this one. Vague accounts have been given of eruptions in Oregon, Washington Territory, and southern California within the last twenty years; but they have not been authenticated or confirmed by subsequent observation of the localities. There are lava-flows and cones in Utah, Arizona, and New Mexico, and also in southern California, whose ages must lie within a very few hundred years, but not within the present century. Unless something of the kind more recent is found in some secluded spot hitherto unvisited by the geologist, I think we may safely regard the eruption at Feather Lake as the most recent of any in the country.

A word or two about the country in which this volcano is situated. It is a volcanic region of great extent, covering probably twelve thousand square miles; and Lassen's Peak is its culminating point, and nearly its geographic centre. It is thickly studded with great volcanic piles, and buried thousands of feet deep in ancient lavas. Most of the eruptions are of great antiquity, and those which built the central pile of Lassen's itself are among the

oldest. Some of the volcanoes are younger, and a considerable number of smaller cones may have been built within a few thousands of years. C. E. DUTTON.

COMETS II AND III OF 1884.

IT is quite remarkable, that, of the five comets visible during the year 1884, four should have been periodic, and two of these of short period, and observed apparently for the first time at this return. By short period is generally understood a period of somewhere in the neighborhood of five years, of which we have well-known examples in the comets of Encke (3.3 years), Brorsen (5.5 years), Winnecke (5.7 years), Faye (7.4 years), etc., — twelve in all.

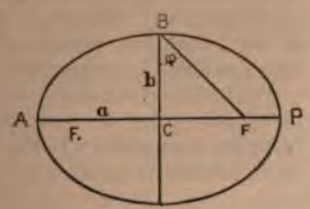


FIG. 1.

The new comets referred to are comets II and III of 1884, — the first discovered by E. E. Barnard of Nashville, Tenn.; and the second, by Max Wolf, a student at Heidelberg. Neither of these comets has been a conspicuous object, — not even visible to the naked eye, I believe, — but they are fair representatives of the class known as 'telescopic' comets.

As I have intimated, the orbit of comet 1884 II (Barnard), is elliptical with a period of about five and a half years. Making allowance for necessary uncertainty, the elements show a certain resemblance to those of DeVico's 'lost comet,' 1844 I, which, though certainly elliptical, has not been seen since, if we except a single rather doubtful observation made at Paris in 1855. The period agrees very well with that determined for DeVico's comet by Brünnow (5.469 years); but Berberich has pointed out that their identity cannot be assumed, for the time elapsed since 1884, forty years, does not correspond to any whole number of revolutions. He notes, also, that the physical appearance would seem to be against this identity; DeVico's comet, in a similar position with respect to the earth, having been visible to the naked eye. Leverrier thought it very probable that this comet of DeVico's was identical with one observed in 1678 by La Hire; and Laugier and Mauvais concluded that it was identical with the comets 1585, 1766 II, and 1819 III or IV.

Below are the elements of the two comets, brought together for comparison. DeVico's comet was computed by Brünnow; Barnard's, by Frisby.

Comet 1884 II (Barnard).

T	= 1884, Aug. 16.2895, Greenwich M. T.	
π	= 306° 10′ 9″.4	Mean equinox, 1884.0.
Ω	= 5° 23′ 51″.2	
ω	= 300° 46′ 18″.2	
i	= 5° 24′ 48″.7	
ϕ	= 34° 51′ 49″.3	
log a	= 0.474164.	
μ	= 689″.858.	
Period	= 1878.65 days.	

Comet 1844 I (DeVico).

T	= 1844, Sept. 2.511238, Berlin M. T.	
π	= 342° 30′ 49″.6	Mean equinox, 1844, Sept. 0.
Ω	= 63° 49′ 0″.1	
i	= 2° 54′ 50″.3	
ϕ	= 38° 8′ 42″.0	
log q	= 0.0742308.	
μ	= 649″.1503.	
Period	= 1996.46 days.	
Motion direct.		

Let me try to show how these elements represent the orbit of a comet, and to give an idea of the shape of this orbit, and its position in space with respect to the sun and earth. By far the most satisfactory way of doing this would be to construct from the elements a cardboard model, which I think can be done with little difficulty from the following directions.

We know, that, in obedience to the law of gravitation, comets must move about the sun in some form of conic section, — the ellipse, parabola, or hyperbola. As a matter of fact, for the majority of comets, the orbit is given as a parabola; a few are known to be elliptic; but it cannot be said with certainty that any are hyperbolic.[1]

We are first to fix the shape and dimensions of the curve, and then its situation with reference to the plane of the ecliptic, in which the earth moves.

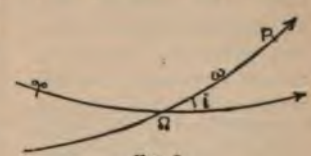


FIG. 2.

Suppose, for a moment, that the orbit is an ellipse, the sun being at one focus (F, fig. 1). Two of the 'elements' determine the form of the ellipse: —

1. The semi-major axis CP, which is denoted by the letter a.

2. The eccentricity e, the ratio of the distance from the centre to the focus, to the semi-major axis; that is,

$$e = \frac{CF}{CP}.$$

[1] Newcomb's 'Popular astronomy.'

For the ellipse the eccentricity is always greater than 0, and less than 1; and, the nearer it is to 1, the more elongated is the ellipse.

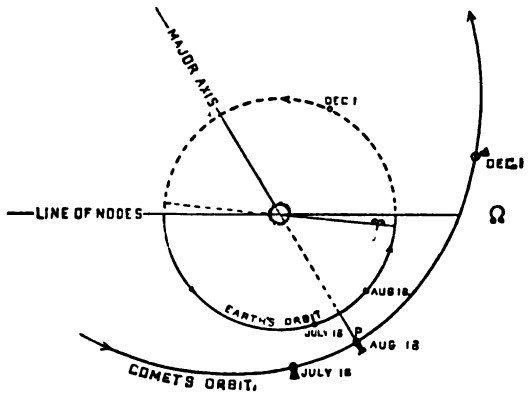


Fig. 3. — Orbit of Barnard's comet.

Instead of e, the 'eccentric angle' ϕ, or CBF in the figure, is sometimes given; but from it we can obtain e by means of the relation

$$e = \sin \phi.$$

I might say that the linear distances a and e are usually expressed as decimal parts of the earth's mean distance from the sun. If $a =$ 2.98 (as in the case of Barnard's comet), it means that the mean distance of the comet, or the semi-major axis of the orbit, is 2.98 times that of the earth, or about two hundred and seventy-six million miles. So, generally, measurements expressed in this way are reduced to miles by multiplying by ninety-two and a half million.

Having settled the shape of the orbit, we must determine its position in space. For this purpose three more elements are required: —

3. The longitude of the ascending node, the angular distance from the first point of Aries (Υ, fig. 2) to the point in which the comet pierces the plane of the ecliptic in passing from the southern to the northern side. It is usually denoted by the symbol ☊. The opposite or descending node is denoted by the symbol ☋.

4. The inclination, i, of the plane of the comet's orbit to that of the ecliptic.

5. The longitude of perihelion, π, which in fig. 2 is the arc $\Upsilon ☊ + ☊P$, or

$$\pi = \Omega + \omega.$$

6. Finally, we must state where the comet is in its orbit at some specified time. For comets we generally give the date of perihelion passage, T.

To these six elements there might be added the mean daily motion, μ, expressed in seconds of arc; and the period of revolution, sometimes called U, in days or years.

With the semi-axes a and b given (b is obtained from a and ϕ by means of the formula, $b = a \cos \phi$), the curve is constructed to any scale we please. I have found it convenient to use a scale of two inches. The earth's orbit is then represented with sufficient

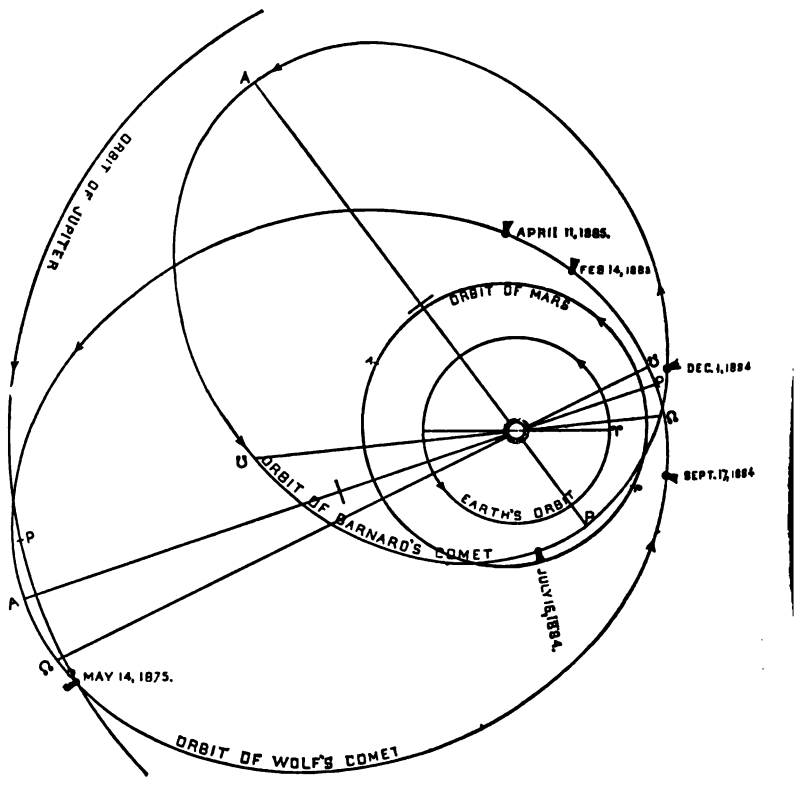


Fig. 4. — Orbits of comets 1884 II and III.

accuracy by a circle with a radius of two inches; and on the circumference we mark the vernal equinox (♈, fig. 3), — a zero point from which longitudes are to be measured. We count in the direction opposite to the hands of a watch, which is also the direction in which the earth moves. We mark also the 'line of nodes' (fig. 3), — the line in which the two planes intersect, making the angle ☊ with the line of the equinoxes.

is 'retrograde,' they will be moving in opposite quadrants. The centre of our circle, and the focus of our ellipse, are, of course, made to coincide.

For a parabolic orbit, the construction of a model is not materially altered, though there is this important difference between a parabola and an ellipse. The parabola is an 'open' curve, and, the farther we recede from the sun at the focus, the farther apart do the branches

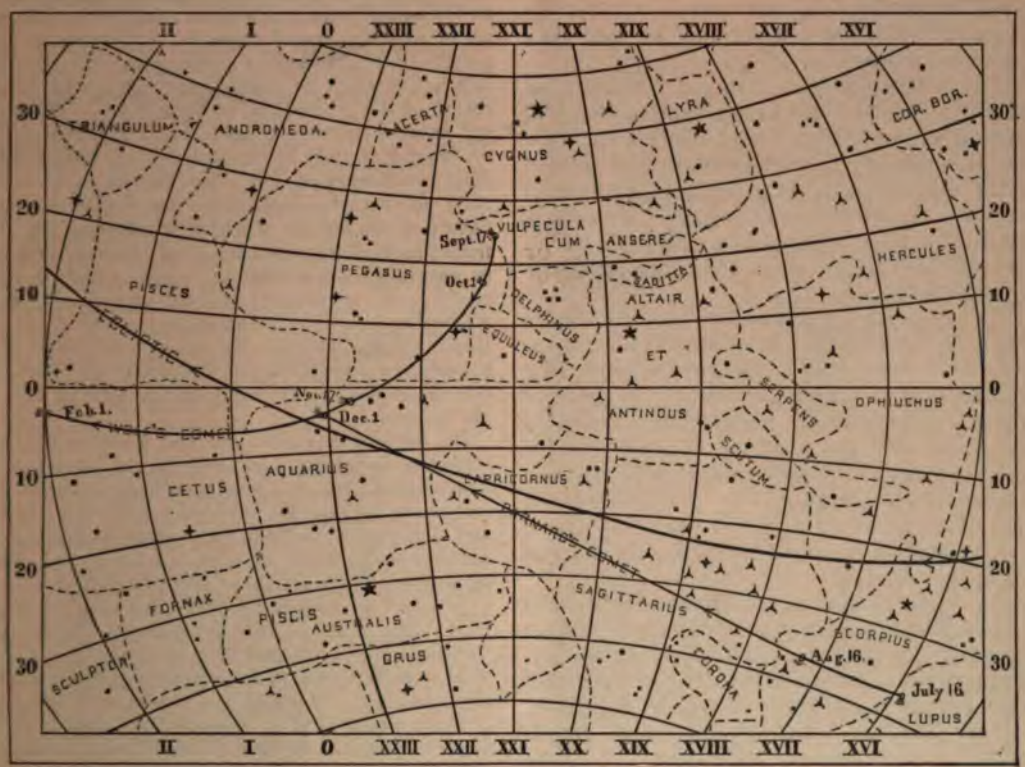


FIG. 5. — APPARENT PATHS OF COMETS 1884 II AND III.

The next thing we want to know is how the major axis of the comet's orbit is pointing. This is determined by supposing that P and ☊ (fig. 2) at first coincide, and then that P is moved till $P☊ = \omega$ (in fig. 3 this angle is 300° 46′, so that the acute angle $☊⊙P$ is 59° 14′). The planes are inclined at the angle i (not shown in fig. 3, but given in fig. 2); and it only remains to fasten the two pieces of cardboard in this position, cutting a slit in either one, so that they will fit together. If the comet's motion is 'direct,' the comet and earth will be moving in the same quadrant, as they move away from the node. If its motion

become; and consequently a comet moving in such an orbit, will, if undisturbed, 'double' the sun, and then go off forever on its journey through space.

For the parabola, the elements are given in a little different form. The eccentricity is equal to 1. The major axis stretches out to infinity, and we give in its place the perihelion distance q, and the distance from the focus to the vertex of the curve PF (fig. 1). But five elements are then necessary to represent the parabola.

Collecting these symbols for reference, they are as follows: —

T = time of perihelion passage.
π = longitude of perihelion.
$\omega = \pi - \Omega$.
Ω = longitude of the ascending node.
i = inclination of orbit.
e = eccentricity = $\sin \phi$.
ϕ = eccentric angle.
a = semi-major axis, or mean distance.
q = perihelion distance.
μ = mean daily motion.
U = period of revolution.

The equinox to which the elements are referred is given, since the vernal equinox is continually shifting on account of the slow motion of precession.

With what has gone before, I think that very little need be said in explanation of fig. 3, which is drawn from a model made as I have just described. The true form of a portion of the comet's orbit is given, and upon it is projected the earth's orbit, which, with such a small value of i, appears here again as a circle. The positions of the earth and comet are given for several dates.

Fig. 4 shows the entire orbit of Barnard's comet (as well as that of Wolf's comet, presently to be mentioned), the earth's orbit, that of Mars, and a small portion of the orbit of Jupiter. These orbits are all represented in one plane, and on so small a scale the inclinations are not great enough to cause any appreciable distortion. For the comets, the lines of nodes and the major axes are drawn in. Perihelion in all of the orbits is marked P; aphelion, A.

Fig. 5 is a map of a portion of the heavens showing the apparent path of the comet among the stars during the period of its visibility. It was in the constellation Lupus when first seen, and moved towards the north and east, through the constellations Scorpius, Sagittarius, Capricornus, and Aquarius. The place of the comet is given here, also, for July 16, the date of discovery; Aug. 16, perihelion passage; and Dec. 1, the limit of visibility.

Comet 1884 III (Wolf). — Wolf's comet, an insignificant object physically, is moving in an orbit of unusual interest. Its period is about six and three-fourths years. The entire orbit is shown in fig. 4, where two of the most interesting peculiarities are brought out, — a near approach to Jupiter in longitude 209°, May, 1875 (about eight million miles); and a near approach, at the descending node of the comet, to the orbit of Mars. From both of these planets the comet is evidently liable to considerable perturbation, and its past and future history become matters of some uncertainty.

Our chart shows a large part of the comet's apparent path in the heavens during its visibility.

William C. Winlock.

GEOGRAPHICAL NOTES.

The roll of geographical journals is increased by one. The Florentine section of the Italian African society has been authorized by the central council and treasurer to issue a bulletin, the first two fasciculi of which appeared recently. It is intended to be partly eclectic, presenting geographical and especially African news to its readers, and partly the official record of the proceedings of the section. The present number contains an address by Professor Licata on the *rôle* of Italy in the Red Sea, an article by A. Mori on Massowah, and other matters of the same sort; bibliography, including a notice of a number of papers on the zoölogy of Africa, which have appeared from time to time in the annals of the civic museum of natural history in Genoa; African notes; the proceedings of the society; and the annual address of Vice-president Stefanelli on the operations of the section for 1884. The new journal is free to members, or may be subscribed for at the secretary's office, Via San Gallo No. 33, Florence, at the rate of five lire per annum.

Dr. Sériziat has been for two years engaged in collecting Lepidoptera at Collo, in the more wooded district of Algeria, reaching some thirty-five hundred feet above the sea. He has obtained about a hundred and eighty-four species in all, — about as many as are ascribed to the whole of Algeria in the most recent catalogue. There are about fifty-two diurnal species, — just half as many as are found at Basle in Switzerland. The cause of this deficiency is stated to be the small number of succulent plants suitable for the food of larvae, and the incredible multitude of insectivorous birds. It would be a source of gratification if Collo would lend to America her surplus of the latter in place of our own inefficient wild birds; and our climate would, perhaps, be quite well suited to the Algerian birds, at least in certain regions.

On the occasion of the presentation to the Russian representative, of the gold Vega medal recently awarded by the geographical society of Stockholm to Prjevalski, Mr. Elfwing, the American consul, made an address on behalf of the society, which was much appreciated, and which has been reproduced in the 'Revue géographique' of Renaud. Mr. de Berends made a suitable response on behalf of the absent explorer. This is the third award of the medal, the previous recipients being Baron Nordenskiöld and Capt. Palander.

The death of Madam Carlo-Serena, author of geographical articles on the Caucasus, is announced as having occurred in 1884 at an obscure village — Oedips — in Greece, on the borders of the Aegean. She was chiefly noted for her passion for mountain travel, and the courage and energy with which she

bore the concomitant privations and physical exertion it required.

The first general assembly for 1885, of the Geographical society of Paris, took place on the 24th of April. The president, Mr. de Lesseps, gave a brief address, in which he touched upon the much greater sensitiveness to occurrences in little-known lands, which the extension of telegraphs and means of transportation has brought about among the more civilized nations; and the growing importance, from all points of view, of geographical instruction in schools, universities, and even in the reading-matter furnished the general public by the daily and periodical press.

Dr. Ballay, in an address on the new possessions of France in Africa, sums up by saying, that while the Ogowé can never be rendered navigable, it can at least be made useful for *bateaux*. Its basin is naturally fertile, and rich in resources. On the other hand, the country extending from this basin to the Kongo is generally sterile. Ivory is about the only product. There is little to hope for from this region; but it is the beginning of the practicable route for reaching the trade of the upper river, which has inhabitants of intelligence and thrift. The natural products of all this region, such as rubber, ivory, etc., may be expected to become rapidly exhausted. It should therefore be provided that artificial cultivation, new industries and crops, should be introduced and directed by the whites. In this way a permanent trade will arise, and commerce be permanently benefited.

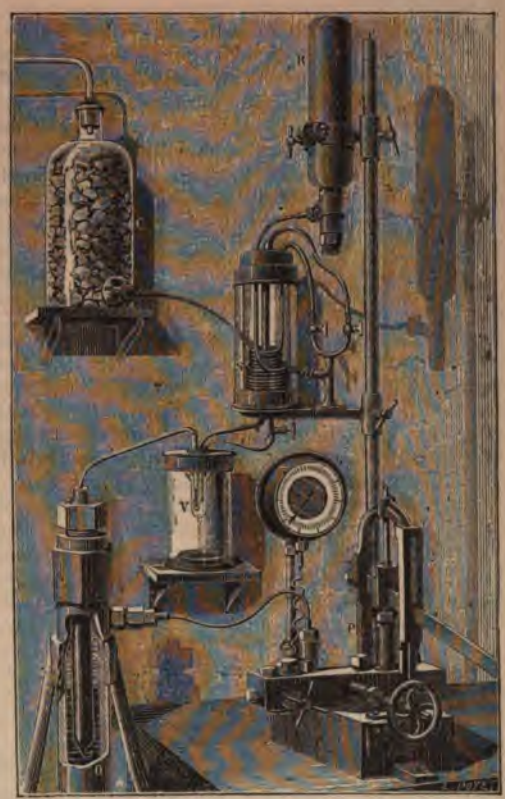
From Iceland, under date of March 21, we learn that the shocks of earthquake which had devastated the vicinity of Husavik, North province, began Nov. 2, 1884, and continued at short intervals, but less energetically, until the 25th of last January. On this day stables were thrown down, springs burst from the ground in new places, and small elevations were visible in a formerly level sandy plain. It is singular that on every historical occasion when earthquakes have been felt in Spain, Iceland has simultaneously suffered: this may be due, however, to the prevalence of earthquakes in Iceland at all times.

The Corwin has returned from Bering Sea to San Francisco for some repairs. She reports the sea ice unusually far south in April and May in that sea. No whales had yet been taken.

THE LIQUEFACTION OF OXYGEN.[1]

LIQUID ethylene, the use of which I have already explained to the Académie des sciences, furnishes, when boiled in the open air, a cold sufficient to cause oxygen, if compressed and reduced to this temperature, to present, when the pressure is diminished, a hard boiling appearance, which continues for an appreciable time. By evaporating the ethylene by the air-pump, the temperature is sufficiently lowered to reduce the oxygen to a liquid state. I have endeavored to avoid the inconvenience and complication which result from working in a vacuum, and to this end have already suggested the use of liquid methane, by means of which the liquefaction of oxygen and nitrogen may be easily brought about.

I thought, however, that, notwithstanding these advantages, ethylene, which is so easily prepared and handled, ought to be preferred to methane; and, by means of ethylene boiled in open jars, I have succeeded



CAILLETET'S APPARATUS FOR THE LIQUEFACTION OF OXYGEN.

in reducing the temperature sufficiently to cause the complete liquefaction of oxygen. The process I use is very simple, and consists in evaporating the ethylene by forcing into it a current of air or of hydrogen at a very low temperature. In my apparatus, the steel receiver *R*, which contains the liquid ethylene, is attached to a copper worm three or four millimetres in diameter, closed by a screw-tap arranged in a glass jar, *S*. On turning into this jar some chloride of methyl, the temperature falls to $-25°$; but if we blow into this air which we have dried by passing it through a flask, *C*, containing chloride of calcium, we soon have a cold of $-70°$. The ethylene thus cooled condenses, and fills the worm. When the tap is opened at the base of the jar *S*, the ethylene flows

[1] Condensed from *La Nature*, May 16.

under a slight pressure, and without apparent loss, into the glass gauge *V*, set, as shown in the figure, in a jar containing pumice-stone saturated with sulphuric acid, to absorb the water-vapor. It is indispensable to work in absolutely dry air; for otherwise the moisture of the air will condense in the form of an icy film on the walls of the gauge, which will become perfectly opaque.

It is then only necessary to evaporate the ethylene by means of a rapid current of air or of hydrogen cooled in a second worm, placed in the jar of chloride of methyl, *S*, to cause the oxygen compressed in the glass tube attached to the upper part of the reservoir *O* to be resolved into a colorless, transparent liquid separated from the gas above it by a perfectly clear meniscus. By working the pump *P*, the water acts on the mercury in the receiver *O*, and forces it into the gauge which contains the oxygen. The gas thus compressed liquefies in the branch of the tube in the gauge *V*. This tube dips into the ethylene at a temperature of — 125°. The mass of liquefied oxygen, which is as limpid as ether, is figured in black in the figure in order that it may be visible. By means of a hydrogen thermometer, I have measured the temperature of the ethylene, which in one of my experiments I found to be — 123°. I am in hope, that, by cooling the current of hydrogen more carefully, the temperature may be still further reduced. The copper worms in which the air and ethylene circulate are dipped into the chloride of methyl, which is rapidly evaporated by a current of air previously cooled. In conclusion, by evaporating liquid ethyl by a current of air or hydrogen much reduced in temperature, its temperature may be reduced below the critical point of oxygen, which in this way liquefies in the clearest form. This experiment is so simple and easy to perform, that it may enter into the regular course in a laboratory. L. Cailletet.

THE FORM OF SHIPS.[1]

In the course of his address, the lecturer briefly explained the great development which the science of fluid resistance had undergone of late years, largely owing to the labors of Stokes, Rankine, and others, but more largely still to those admirable investigations which had been carried out, under the patronage of the admiralty, by the late Dr. William Froude, and subsequently by his son, Mr. R. E. Froude. He likewise explained the very great effect which those investigations had produced in the royal navy, owing to the judicious and prompt adoption of Froude's results by the admiralty constructors. Stress was laid, throughout the lecture, upon the importance of adjusting the form and proportions of ships, not only to the loads which they have to carry, but likewise to the weight of the materials entering into their structure. It was a common error to judge of the merits of steamships by the relations which exist between their displacement, steam-power, and speed, as expressed by formulae of various kinds. Approximations to the theoretical form of least resistance were sought by some naval designers, and all considerable departures from that form were regarded as objectionable. The lecturer, on the contrary, pointed out that no such theoretical form was any true or proper guide for a naval designer, since every change in the average weight of the hull necessitated a corresponding change in the form and proportions of the ship; and the great merit of a designer often was, that he adopted forms differing widely from the abstract forms of the schools, and presenting a very inferior appearance when put into what are known as 'constants of performance.' This was illustrated by examples derived partly from actual ships, and partly from calculations made for the purpose. Two actual war-ships were compared, one attaining the high figure of 213 marks when examined by the received formulae, and the other gaining but 172 marks; yet, in the lecturer's view, the latter was far the better ship, because she performed precisely the same service as the other, being inferior in no respect, and yet had cost less than the other by £114,000, and expended no more steam-power in attaining an equal speed. The lecturer remarked, that he should probably have regarded the abstract 'form of least resistance' with more respect but for the circumstance that the designing of armored vessels, in which he was much engaged, was "a branch of naval construction of much too concrete and ponderous a character to admit of any dalliance with abstract or fancy forms." He went on to express his regret, that owing largely to the restrictions which granite docks imposed upon naval constructors, and to the absence of iron floating docks capable of receiving ships of any form, and owing to other causes likewise, the construction of armored ships — by which he meant ships which had a sufficient volume protected above the water to keep them afloat and upright while the armor remained intact — had been abandoned, and the first place upon the sea had been offered to any nation which had the courage and the will to assume it. In his opinion, this was a purely voluntary abandonment, and was not the result of any scientific or economic necessity. He admitted that great changes in forms and proportions were very desirable in our great line of battleships: for example, a great increase of breadth was necessary in order to economize the side-armor, and to keep the ram and torpedo at ample distance from the boilers and magazines, which should be protected by an inner citadel, so to speak, well removed from the outer one. But, so far was true science from presenting obstacles to these and other important changes, it actually invited these very changes; and increase of beam in particular had been shown by Froude to facilitate the attainment of practical invulnerability combined with very high speed. Size and cost were among the bugbears of our naval administration: by the true engineer they were always regarded as secondary to great and noble objects, among which objects he included the naval pre-eminence of England. At any rate, there was no engineering

[1] From a lecture before the Institution of civil engineers by Sir Edward Reed.

obstacle whatever to England constructing and sending to sea, not merely those great and swift, but delicate and fragile, Atlantic hotels in which the British navy was to embark and fight, for the want of something better, but also war-ships, — real war-ships, capable of bearing the once proud flag of England boldly into the waters of any enemy whatever.

BONE-CAVES IN WALES.

FROM a careful study of the bone-caves in Wales, Dr. Henry Hicks (*Proc. geologists' association*, vol. ix. No. 1) makes some very important conclusions in regard to the contents of the caverns. The evidence shows that the area of North Wales was subjected to very great physical changes during pleistocene times. In the earliest part of the period it was raised to a considerably greater elevation than it is at present, and depressed afterwards in interglacial times to a depth of at least two thousand feet, so that it became a mere cluster of islands. After that, the area gradually rose again, with slight oscillations of level, until it attained its present configuration. Deposits relating to all these changes are to be found either on the Welsh hills or in the valleys, especially in those surrounding the Vale of Clwyd. If an attempt is made to correlate the deposits in the caverns with the glacial drifts of the neighborhood, — the results of the changes referred to, — one would be inclined to look upon the lowest drift in the caverns, that consisting mainly of local materials, as belonging to an early part of the glacial period, i.e., before the great submergence. Possibly this material was introduced into the cavern when the river flowed in the valley at a much higher level than at present, as it has much the appearance of that usually brought down by river-action. As time went on, and the valley became deepened, so that the caverns were above the reach of the floods, they probably became the abodes of hyenas and other beasts of prey, or places where animals retired to die. During the epoch of great submergence, as soon as the caverns were on a level with the sea, they were probably filled with sand, and the animal remains became entombed in them. This sand is now found in the cavities of the bones, and occasionally cemented to them. In the period of upheaval which followed, as soon as the water was again on a level with the caverns, it washed out most of the sand, and carried in with it, instead, the muddy and other materials which had been deposited in the neighborhood by floating ice. By this means there was produced a general re-arrangement of the contents of the caverns. It was as the waters receded that the upper bowlder-clays were deposited both in the valleys and caverns. The abundance of bones in the caverns, and their very rare occurrence in the bowlder-clays of the valleys, prove almost conclusively that they must have been accumulated in the caves, and not washed in from the bowlder deposits near by. The proof furnished that the bones must have been buried in a marine sand before they were enclosed in the present cave-earth, is strong evidence that the animals occupied the cavern in very early glacial times. Whether man also lived in the area at so early a period, cannot at present be decided by any evidence, as the flint implement found with the bones in Cae Gwyn Cave might have been introduced at a later period. It is, however, interesting to know that it appeared to be associated with the reindeer remains, and that the type is supposed to characterize what is called in France the 'reindeer period.'

AN EDIBLE CLAM INTRODUCED ON THE ATLANTIC COAST.

AN interesting shipment of shell-fish has just been received at the Wood's Holl (Mass.) station of the U. S. fish-commission. It consists of nearly eight hundred living specimens of Tapes staminea from the shores of Puget Sound, in Washington Territory, where it is known as the 'little round clam.' It is not unlike the quahaug (Venus mercenaria) in general appearance, though differently ornamented, and not growing so large, and, as in the latter species, the valves fit closely together all around when the shell is closed. This clam is one of the most highly prized of the west-coast species, of which there are several used as food. It is marketed in large quantities in all of the principal towns, and would form a valuable addition to the food-products of the Atlantic coast, if it could be made to thrive here.

The shipment was made in one of the fish-commission cars, in charge of Mr. George H. H. Moore, and was obtained at Henderson's Bay, near Tacoma, Washington Territory, where the clams live on sandy and gravelly bottoms about the level of low tide. Between four thousand and five thousand specimens were secured, and first packed in wet sand, in the large stationary tanks on both sides of the car, filling a space about twenty-four feet long by two feet wide. The sand was moistened twice a day with sea-water at a temperature of about 56° F. During the first four days not over fifty of the clams died; but at the end of that time, as they were evidently not doing well, they were taken from the sand, and kept for a few hours in pure sea-water.

Then they were transferred to a bed of sand in which the shells were laid with the ventral margin uppermost, and covered with rock-weed which was kept constantly wet. During the next two days the mortality was very great, and it was thought best to try the salt water again. They were accordingly placed in tin cans of sea-water, in which they completed the rest of the journey, arriving at Wood's Holl, Friday, June 26, about seven days from the time of leaving Tacoma, where, however, they had been kept in the tanks two or three days before starting. On the last day of the trip, over seven hundred were lost, and the exact number received at Wood's Holl was seven hundred and sixty-eight. These were transferred to a suitable sandy beach, into which many began to burrow at once. It is impossible to predict how many of those brought over will recover

from the shock of the long journey, but a number appear to be active in their new home.

In this connection it may be interesting to note that the common east-coast soft clam, Mya arenaria, which was introduced on the Pacific coast several years ago, has become thoroughly acclimated there, and is now very abundant.

WORK OF THE CHALLENGER EXPEDITION. — II. FROM A ZOÖLOGICAL STAND-POINT.

After the investigation of the physical features of the world of the sea, it was expected and has proved that the greatest additions to our knowledge would be made by the expedition in the direction of biology. From the summaries furnished by the specialists engaged on the various monographs, and printed at intervals in the text of these volumes, a few facts may be cited in the endeavor to give an approximate idea of the scope and character of the results.

The main purpose of the expedition, on the biological side, was to investigate the marine life of the sea, and incidentally to examine the life of certain isolated oceanic islands, — faunae pregnant with meaning for the naturalist, though scanty in species or individuals. Both objects were carried out in a manner satisfactory to naturalists, and creditable to the officers of the expedition. The air-breathing vertebrates, of course, were little sought after, but interesting observations are recorded on the sea-elephant and fur-seal; and the bones of cetacea dredged from the sea-bottom were sufficiently numerous and interesting to justify a special report on them by Professor Turner. The expedition seems to have needed a live harpooner, for it got no porpoises during the whole voyage, though many played about the ship. The birds collected, though not extremely numerous, were of great interest, and have been reported on by Dr. Sclater, the Marquis of Tweeddale, Dr. Finsch, Count Salvadori, Messrs. Saunders, Salvin, and Garrod. The death of the latter prevented the completion of his work on the anatomy of the petrels, which was taken up by the late W. A. Forbes, who made an exhaustive report on the subject, showing that the order of Tubinares must be divided, as proposed by Garrod, into two very distinct families characterized by numerous and important differences, — which indicate not only a great antiquity for the whole group, but a great amount of extinction among its past members, in the process of which nearly all the intermediate or less specialized forms are believed to have disappeared. Professor Cunningham has reported on the marsupial mammals; Professor Parker, on the development of the green turtle; and Professor Turner, on the human crania collected during the voyage. The report on the deep-sea fishes, by Dr. Günther, is still a desideratum, but will unquestionably be of great interest. Some preliminary notes appear in this volume. A great similarity between the fish fauna of the Japan seas, the West Indies and adjacent Atlantic Ocean, and the Mediterranean, is clearly shown. At St. Paul's Rocks a new species of Holocentrum was found, but the fish fauna had a generally Antillean character. A remarkable fish, Bathypterois, was found on the coast of Brazil, with rudimentary eyes, and part of the pectoral fins modified to form extremely long tactile filaments. Another, Ipnops, dredged in the ocean at a depth of 1,900 fathoms, had the eyes modified to such an extent as to resemble two scale-like plates on the top of the much-flattened muzzle. No image can be formed in them, but they may serve for detecting minute quantities of light. Still another, Echiostoma, has eyes and formidable teeth, with long filaments extending from the chin and pectorals. A series of luminous globular bodies extends along the lower part of the body, and others of larger size are found on the head. The bones and ligaments of the deep-sea fishes are very soft, and the muscles loosely connected with each other. This is partly due to the expansion which they undergo in being raised quickly from regions where the water permeating all their bodies is under immense pressure; but the tissues must be loose to admit of such permeation, or they would be crushed and ruined under a weight which shivers solid glass to powder. Many of them are blind; many of them have phosphorescent organs, or secrete a phosphorescent slime; others have distensible stomachs and wide mouths, which ingulf fishes much larger than themselves.

Turning to the division of invertebrata, we find ourselves more than embarrassed with riches. The mollusks being in the hands of Rev. Boog-Watson and Mr. E. A. Smith of the British museum, who have so far submitted only preliminary notices, we learn chiefly of some special rarities, such as the paper-thin volute, Guivillea, from the depths of the Southern Ocean, or the beautiful Pecten Watsoni, of the section Amussium. Mr. Smith reports, in harmony with the results of the Blake expedition, that among the bivalves dredged from a depth of over 2,000 fathoms

he does not find one which might not have been expected at 100 fathoms or less. The deepest haul producing any bivalve was 2,900 fathoms, where Callocardia was found in the Pacific, and an almost exactly similar species was obtained at 1,000 fathoms off the Azores, in the same latitude of the Atlantic. On the whole, lamellibranchs were scarce: but this may have been owing to the use of the trawl instead of the dredge. The greatest depth at which any gastropod was found was 2,650 fathoms, in the South Atlantic; and this was a little Stylifer parasitic on an echinoid. The fossil genus Actaeonina was a find worth having; and many, like Gaza and other trochids, were of great beauty. A number of arctic species were found at home in the antarctic sea; and several others seem to wander over most of the world. Professor Haddon reports a chiton (C. [Leptochiton] alveolus Sars) from 2,300 fathoms, which was the only really deep-sea species found of this ancient group, though several others of the same genus range over 300 fathoms. Among the nudibranchs, an immense creature, Bathydoris abyssorum of Dr. Bergh, as big as a cocoanut (twelve centimetres long), forms a remarkable transition between Tritoniidae and Doridiidae, and was obtained at 2,425 fathoms. It is the largest nudibranch known, and was purple, brown, and orange colored when alive. Among treasures from shallower water were a living Nautilus pompilius and a partly decorticated Spirula.

It is impossible to give an account of the varied, beautiful, aberrant, or exquisite forms of the crustacea, star-fish, echinoids, and brittle-stars which were brought up from the deep sea. Their attractions for the eye of the aesthete as well as of the naturalist are obvious to any one who may examine the charming woodcuts which illustrate their form and structure. The sea-lilies are among the most attractive; and yet it is hard to choose from among so many any special group as, on the whole, the most beautiful.

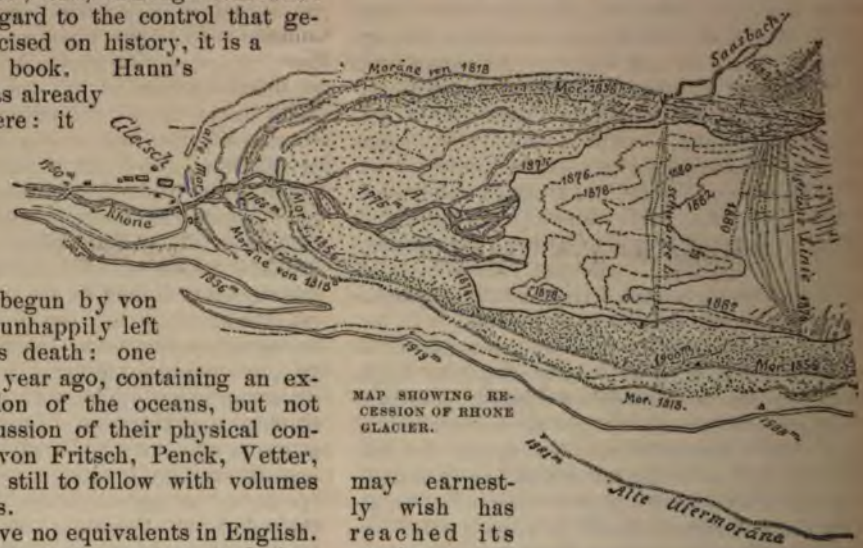
Among the worms, decidedly the most extraordinary is Syllis ramosa, — a creature living in sponges, not satisfied with shaking off its progeny by dropping sections from its tail, but which actually branches in all directions laterally, and shares with these collateral relations the ramifications of its stomach. In another form, Genetyllis, the head is composed of little more than two enormous eyes, with a large median nerve-mass with which the retina of each is continuous. Some worms have tubes five yards long: others ornament their dwellings with hyaline sponge spicules or spiny processes. They reach depths of 3,125 fathoms, and range to the surface, the Serpulae and Terebellae being the most noteworthy in this respect.

The consideration of the calcareous and horny sponges was undertaken by Dr. N. Polé-jaeff of Odessa, who, after demolishing all previous attempts at their classification, aptly compares the systematist to a man wandering in the dark, — a condition in which the synopsis of his memoir certainly leaves its reader. The number of species was not large, and none of them came from great depths, though many were undescribed. The group of sponges to which the beautiful Venus's flower-basket, Euplectella, belongs, offers, as might be expected, many new and exquisite species, which are illustrated in a manner worthy of their attractions. Prof. F. E. Schulze reports that the Challenger collection has more than doubled the number of known species, which now amounts to more than one hundred. The tropical zone of the Pacific is the richest region, eighteen species having been obtained at one haul, in the vicinity of Papua; but the largest total number of species comes from the Southern Ocean. They are essentially abyssal animals. The richest additions to any single group of marine animals made by the expedition were to the Radiolaria. These rhizopods are now known to differ from the foraminifera and heliozoa chiefly by the separation of their unicellular body into an inner and an outer series of constituents. With few exceptions, they are remarkable for their skeletons, of the most varied and delicate form, and of siliceous or chitinous structure. They swim in numbers at the surface, or even at great depths; and the ooze at even the greatest known depths is often composed of astonishingly vast numbers of their delicate skeletons. From a few hundred known forms, the work of the Challenger has expanded the list to several thousands, among which Professor Haeckel has distinguished six hundred and thirty-four genera, included in twenty-four families and several orders. It must, however, be borne in mind that these systematic divisions are far from having the zoölogical value of divisions similarly styled in higher groups, though here perhaps necessary from the multitude of species. We have regretted the necessity, from considerations of space, for omitting references to the admirable and epoch-making work of Professor Moseley on the corals, confirming and extending the work of the elder Agassiz, or that on the foraminifera and diatoms, both of which exhibit forms of great beauty, which are excellently

figured. But nearly every page contains matter which would be of interest to readers of *Science*, and unfortunately we cannot yet print numbers in twelve hundred pages quarto. We are obliged to reserve our concluding paragraphs for the geological aspects of the voyage.

GLACIERS, AND THEIR RÔLE *IN NATURE.*

Professor Ratzel's 'Bibliothek geographischer handbücher' reaches its fourth volume in Heim's comprehensive review of what may be called 'glaciology,' — a general discussion of glaciers, and the part they play on the earth's surface. It is fully up to the high standard attained by the earlier numbers of the series. Ratzel's 'Anthropogeographie' was the first issued; and, although somewhat venturesome in regard to the control that geography has exercised on history, it is a very suggestive book. Hann's 'Klimatologie' has already been reviewed here: it has everywhere received high praise, and at once takes its place as a standard work. The 'Ozeanographie,' begun by von Boguslawski, was unhappily left incomplete on his death: one part was issued a year ago, containing an exhaustive description of the oceans, but not reaching the discussion of their physical conditions. Drude, von Fritsch, Penck, Vetter, and Zöppritz are still to follow with volumes on special subjects.



MAP SHOWING RECESSION OF RHONE GLACIER.

These books have no equivalents in English. It is becoming very monotonous to record, time after time, that German writers are so far in advance of us; but the fact is very plain. If such works cannot be originated here, we wish that they might at least be translated and republished, so as to come within reach of our teachers and students.

Professor Heim has hitherto been known rather as a worker on mountain structure than on glaciers. His studies in the direction of the latter subject, so far as they are published, have been concerned chiefly with the share that ice has had in mountain sculpture; but the book now before us shows deliberate and careful work on all topics connected with glaciers of the present time. The reference made to their former extension is sufficient for a volume that professedly does not discuss that part of the question. As in the earlier numbers of the series, illustrations and references to authorities are practically wanting. An index is also absent in this volume; but its place partly taken by a well-arranged table of contents and page-headings. Our many students of the difficult problem of North-American glaciation will find much of value in the summaries of recent Swiss studies on the structure of glacial ice, of observations in Greenland on the motion of the great glaciers there, and of the many suggestions to account for glacial motion, as well as in the accounts of existing glaciers and their oscillations.

The remarkable recession of the Swiss glaciers during recent decades, which travellers may earnestly wish has reached its maximum, is finely illustrated in the figure of the glacier of the Rhone, of which a part is copied here. The measurements carried on of late years, under the direction of the Swiss alpine club, give precise data on this matter, and, if continued long enough, will undoubtedly in the end lead to the discovery of the cause of glacial oscillations in the peculiarly dry or wet, warm or cold, weather of some antecedent series of years; the effect leisurely following the cause, as the excess or deficiency of upper snow supply arrives at the lower end of the ice-stream. A view of the Rhone glacier, as it was at its recent maximum extension about 1820, is given in de Charpentier's 'Essai sur les glaciers,' and offers a striking contrast

Handbuch der gletscherkunde. Von Albert Heim. Stuttgart, *Engelhorn*, 1885. 16+360 p., map. 8°.

to the little remnant of ice at the foot of the steep slope, as seen by travellers of last summer.

The anatomy of the greatest glacial system of Switzerland, that which forms the Aletsch glacier, is excellently shown in a folded map. The scale is 1 : 50,000 ; contour lines are drawn in blue on the ice and snow every thirty metres ; the moraines are marked in detail ; and the peculiar zigzag bands in the ice, like the grain of wood, so conspicuous in the wonderful view from the Eggischhorn, are carefully represented. This map may therefore be ranked even above the interesting one of the 'Mer de glace' system (scale, 1 : 40,000) on Viollet-le-Duc's sheet of the 'Massif du Mont Blanc,' published about ten years ago.

The question of glacial erosion has always been fruitful of opposite views since it was first given importance by Ramsay ; and we have to regret that the summary of the matter presented by Heim does not go further in reconciling the apparently contradictory facts quoted by the advocates of the contrasted theories. Heim writes, 'Glaciation is a period of rest in valley-making.' Professor Newberry concludes[1] that a great glacial sheet, shod with stones and gravel, "would not only be capable of sweeping away any ordinary barriers that opposed its progress, but would grind down the underlying rock with a resistless and comparatively rapid action."

Neither of these authors gives sufficient indication of the more judicious middle ground taken by James Geikie and some others, to the effect that glacial action may be destructive in one district, and constructive in another ; that glaciers, like rivers, erode chiefly in their upper streams, and deposit the detritus quietly on the flood-plains and deltas of drift near their termination. The great amount of glacial drift undoubtedly affords the strongest argument that can be made in favor of the marked changes effected by glaciers, just as the vast volume of stratified fragmental rocks testifies to the successful persistence of water-action ; and for North America, at least, we cannot accept Heim's conclusion, that pre-glacial weathering afforded the chief part of the drift, while direct glacial erosion gave rise only to fine sand and mud. The occurrence of angular, unweathered, and unworn bowlders, and of drift rich in limestone, forbids such a conclusion, and has been successfully quoted against it. On the other hand, the evidence of the protective, or at least the very moderately destructive, action of the old glaciers near their termination, and the not excessive erosion in any part, is ably stated ; and, to our mind, this leads much nearer to the truth than does the path followed by those who see an argument for glacial erosion in nearly every lake of northern countries and every fiord of western coasts.

[1] School of mines quarterly, vi. 1885, 152.

HOUSEHOLD SANITATION.

IF the author succeeds in winning the audience she desires, she may justly claim pioneership in one direction of the higher education of women. The path indicated is not well beaten. Sanitary science is of late origin ; so late, indeed, that the men who formulated it are still young. Its proposition to prevent disease by removing the conditions that provoke disease, merits the popular approval, and legislation has been quick to help sanitarians put their science to the test. With plenty of money, and in fair localities, it is not difficult to satisfy all the demands of the sanitarians. It will, however, hardly be contended that the sanitarians have formulated insurance against the outbreak of the zymotic diseases for the ordinary householder in any locality where necessity has placed him. And yet this is the very problem which sanitary science is to solve. Much can be done in one home to make it healthful ; but the influences that affect one home are so intermixed with the influences that affect large areas, that state and national interference is demanded by sanitary science. The author has stated the sanitary conditions of healthful homes with accuracy, and with sufficient fulness to make these conditions readily comprehended. She appeals to the women of the land to familiarize themselves with the results of sanitary science, that they may be able to critically examine their own homes, and influence opinion, so that healthful conditions may be made compulsory under the law. This is good work, and the more of it the better. There is an immense chasm between crazy-quilts and sewer-pipes, sonatas and bad drainage ; but it can be bridged by informing the women, and teaching the girls. If rosy children and long-lived husbands are worth the while, this education in what constitutes a healthy home is worth a place in the school curriculum for girls.

Sanitary science is so new, that 'consulting sanitary engineers,' without warrant of author-

Women, plumbers, and doctors ; or, Household sanitation. By H. M. PLUNKETT. New York, *Appleton*, 1885. 248 p., illustr. 8°.

ity, are plentiful, and 'sanitary plumbing' is the unvarying advertisement. Implicit faith in either class is ill advised. The skill of the one and the handicraft of the other may safely be questioned and criticised. The easy conscience of the contractor, no less than the ignorance of the owner, makes poor plumbing-work possible, for much of it is hidden from sight. Smoothly wiped joints, with brass and plated fixtures, do not always insure sound and honest workmanship. The complexity of this plumbing problem in the great cities, with their crowded populations, must be solved through the agency of general legislation, and the authority of inspection must be derived from stringent laws. The state boards of health were organized with this end in view, and their conclusions are influential with the law-making powers. Sanitary science includes so much, and affects all to the degree that *men* have no monopoly in its results. Mrs. Plunkett is right in contending that *women* should master these problems to aid in procuring compulsory legislation. Her little tilt at the doctors on the titlepage is very much softened in the final paragraphs of her book. The millennium is not quite at hand; and as the doctors discovered the causes that brought sanitary science into existence, and have done all that has been done thus far in formulating it, and as they must be the final court of appeal in all questions that arise before sanitary science is rounded out and complete, the medical profession will probably see several generations before its 'occupation's gone.'

NOTES AND NEWS.

The following short account of a tornado at Aden, reported by Commander Merrill Miller, U.S.N., commanding the U. S. steamship Marion, is interesting from the fact that it is the first violent storm that has visited Aden since the English occupation. On June 1 and 2 the weather at Aden was sultry and threatening, with moderate easterly breeze and sea. The sailing-directions give no accounts of storms in this locality. On the morning of June 3 the wind was moderate from north-west, with heavy and increasing swell from south-east. The sky was dark and threatening. At ten A.M., June 3, the wind increased to a gale, with squalls of hurricane force from the northward, and rain in torrents, and very heavy seas from southward and eastward. The sea broke over the rail of the English flagship, which was battened down. The barometer fell to 29.60. At three P.M. the barometer began to rise, when the wind shifted to the southward and eastward, and the gale moderated. Heavy rain-squalls continued at intervals all night. The gale was of the nature of a tornado, and apparently passed up the Gulf of Aden in a westerly direction. Vessels arriving from the Indian Ocean and the Red Sea report having encountered heavy weather.

— Mr. I. C. Russell's reconnoissance in the northern part of the Great-Basin region, where it extends into southern Oregon (U. S. geol. surv., 4 ann. rep.), has furnished him with a quantity of interesting facts concerning this little-known part of the wide west. Its rocks are largely volcanic, spread out in great sheets of lavas that once formed a broad, smooth tableland; but in later times it has been broken by faults, so characteristic of the Great-Basin region, and thus divided into long, narrow blocks, stretching north and south, and tilted by very recent displacements, so as to expose fresh precipitous scarps that have not yet sensibly worn back from the fault-lines. In the Warner valley, for example, the orographic blocks of dark volcanic rock, miles in length, are literally tossed about like the cakes of ice in a crowded floe, their upturned edges forming bold palisades that render the region all but impassable. The faces of the numerous branching fault-cracks present naked precipices without system, that combine to make a region of the wildest and roughest description. The depressed areas were occupied, during quaternary time, by numerous lakes of considerable size. Some overflowed to rivers that reach the ocean, like the Klamath, that escapes westward through the Cascade Range; others contributed to the supply of the irregular basin of Lake Lahontan, farther south; and some had no overflow, their influx being counterbalanced by evaporation, thus indicating that the precipitation of the time was not excessive, and that their waters were saline. At present the waters have retreated from the terraces and benches that mark their former levels, and remain in greatly diminished volume. Some have altogether disappeared, or appear only in the wet season; others are relatively permanent sheets of very saline water, like Summer and Abert Lakes, which may possibly inherit part of their dissolved salts (soda and potash) directly from their larger ancestor; but the most numerous are those which are now essentially fresh, although occupying basins from which the quaternary lakes had no outlet (these are therefore not to be considered remnants left by the incomplete evaporation of the quaternary lakes whose basins they occupy, as in that case they should be densely saline). Their freshness is best explained by Gilbert's hypothesis that the quaternary lakes have been completely dried up, and their saline contents so well buried under playa-mud, that the waters subsequently accumulating in the basins did not take them into solution. Mr. Russell finds no evidence of either local or general glaciation in the region he examined, and thus differs in his conclusions from those reached by LeConte. The report is illustrated by several maps, showing fault-lines, quaternary and existing lakes, by numerous cuts illustrating the peculiar displacements so characteristic of the region, and by a sketch of Abert Lake, in which the tilted blocks that form its basin are shown. It is a valuable and most inter-

esting chapter to add to the physical geography of our country.

— The Portuguese explorer, Serpa Pinto, has found considerable coal-beds south of the Rovuma. The Rovuma flows into the Indian Ocean, south of the German possessions on the east coast of Africa, on the old caravan track from Cape Delgado to Lake Nyassa. These coal-beds were claimed by the sultan of Zanzibar; but, as they lie south of the Rovuma, the Portuguese have taken possession of them.

— Professor Forel of Morges continues his reports to the Swiss-Alpine club, on the periodic variations of the glaciers of the Alps, and in his fifth statement, for 1884, confirms the conclusion announced a year ago, that the decrease of thirty-four di-tinct glaciers has come to an end, and is now followed by a moderate advance. In the valley of Chamounix, the glacier of Argentière crept forward thirty-three feet last year: it had a maximum in 1819, and again in 1854, followed by a minimum in 1883. The Glacier des bois, at the foot of the Mer de glace, shows no change; but that of the Bossons is advancing rapidly, having extended its front about one hundred and fifty feet in the past year; and so with a number of others. Part of the Hôtel des Neuchâtelois, from which Agassiz made his early observations on the Unteraar glacier, has been found twenty-four hundred metres down stream from its position in 1842, giving an average annual velocity of fifty-five metres; but it is curious to note, that as its velocity from 1842 to 1846, when determined by Agassiz, was seventy-three metres a year, its recent velocity must have been about forty metres, to bring the forty years' average down so low as fifty-five. Another peculiar fact found by Forel is that the recent change from retreat to advance is much more common in the western than in the eastern Alps. The observations of the next few years promise to be of special interest in this connection.

— Capt. Downie of the British steamer St. Andrew's Bay, reports that on June 25, in mid-ocean, a meteor resembling a ball of fire two feet and a half in diameter descended from overhead a short distance from his vessel. This occurred about noon. The weather was misty and rainy, but there had been no lightning or thunder. The flash made by the passing meteor was so brilliant that it blinded those who witnessed it. The meteor exploded with a terrific report, resembling cannonading, followed by a noise like the rattle of musketry. Immediately after the passage of the meteor the weather cleared up. The vessel was loaded with iron ore, but there was no play of electricity upon any part of her.

— The third report of the Swiss seismological commission, by Forel, covers the years 1882 and 1883. It gives a list of the earthquakes observed during the two years in Switzerland, with the accessory shocks. The intensity of each earthquake is marked according to the Rossi-Forel scale, and its 'value' computed by the formula adopted by Forel in previous reports, which takes into account the intensity number, the extent of the seismic area, and the number of accessory shocks. These numbers are tabulated, and compared with the mean of the two years 1880 and 1881, and with the separate numbers for those years. The means deduced from the several tables are as follows: —

	1880.	1881.	Mean of 1880-81.	1882.	1883.
Number of earthquakes . . .	–	–	29.0	29.0	15.0
Number of shocks,	–	–	116.0	49.0	19.0
Mean intensity .	3.9	4.2	4.0	3.7	3.6
Mean 'value' . .	10.1	15.1	–	7.4	5.7
Annual sum of 'values' . . .	211.0	574.0	273.0 *	220.0	87.0

* Mean of the four years.

From these figures the author infers that there was a maximum of seismic activity in Switzerland in 1881, which a comparison of the *monthly* values shows to have been in November of that year; and that in 1882 and 1883 the activity was notably diminished, especially so in the latter year, in which only one earthquake (Jan. 8) exceeded a value of 10, and none exceeded 15. In the figures tabulated, no account was taken of twenty-one slight shocks, twelve in 1882, and nine in 1883, which were only reported by a single observer.

— Dr. M. E. Wadsworth has accepted a position as professor of mineralogy and geology at Colby university, Waterville, Me. We understand, that, as at Cambridge, he will continue to give instruction to advanced students in lithology; and there will thus be one more opportunity for those who intend pursuing this growing science to familiarize themselves with the latest methods of investigation.

— The Berlin congress, says the *Athenæum*, appears to have stirred the Portuguese Commissão de cartographia into activity. Among a batch of maps recently forwarded to us from Lisbon, we find a capital general map of the province of Angola, compiled by A. A. d'Oliveira, on a scale of 1:3,000,000, which distinguishes salubrious from insalubrious districts, and shows, among other novel features, the recent routes of Capello and Ivens to the east of Mossamedes; a map of the country between Loanda and Ambaca, on a scale of 1:400,000, based upon railway surveys made by Major A. S. de Souza Prado, Major Goyão, and others, and of much original value; and, lastly, a map of the lower Kongo up to Noki, from recent surveys by L. de Moraes e Souza, C. de Magalhaes, and E. de Vasconcellos. These maps are reproduced from autographs, and their external aspect is consequently not very inviting; but they contain matter which the cartographer cannot afford to neglect. We are glad to hear that maps of the island of St. Thomas, of Angola (on a scale of 1:1,500,000), and of Mozambique, are preparing by the Commissão de cartographia, under the direction of Senhor Leite.

— A remarkable instance of the tenacity of old beliefs among an ignorant class lately occurred not

very far from Calcutta. The idea that government always inaugurated every good work with human sacrifice was long current among the lower orders of the Indian people; but it might be supposed that it had died out long ago. It appears, however, to be as strong as ever. The boatmen on the Ganges near Rajmehal somehow came to believe that the government required a hundred thousand human heads as the foundation for a great bridge, and that government officers were going about the river in search of heads. A hunting-party, consisting of four Europeans, happening to pass in a boat, were set upon by the hundred and twenty boatmen with the cry, 'Gulla katta,' or cut-throats, and only escaped with their lives after the greatest difficulty. The men were arrested, and thirty-one of them sentenced to terms of from one to three months' imprisonment.

— The demolition of the oldest Jewish quarter in Europe, dating, it is said, from before Caesar's time, is proceeding rapidly. The archeological commission, which is charged with the exploration and protection of ancient monuments, has applied to the Italian government that measures shall be taken for clearing the temple of Jupiter and the portico of Octavia from the buildings which have grown up around them, and also for putting them in such a state of repair as is necessary for their preservation. The commission also requests that the new streets which are to be laid down over the cleared area shall be so planned that their points of intersection shall coincide with the following ancient buildings, which are now within the Ghetto: the theatre of Marcellus, the crypt of the Emperor Balbus, and the porticos of the Flavian emperors and of the Emperor Philip. There is a supplementary request that these buildings shall be placed on the list of ancient monuments, for the preservation of which a small contribution is annually made by the state.

— The African expedition which will leave England in August next, fitted out at the expense of the Royal geographical society, and commanded by Mr. J. T. Last (who, as a lay agent of the Church missionary society, has done admirable work in the Zanzibar interior), after making up its caravan at Zanzibar, will proceed south to Lindi, to the north of the mouth of the Rovuma River. Thence Mr. Last will proceed to the confluence of the Rovuma and Lugende rivers, and fix the longitude of the junction, — an important geographical point not yet settled. He will then go on in a generally south-westerly direction, and, before reaching the north end of Lake Sherwa, turn southwards, and make for the Namulli Hills, which, with other new features in this region, were discovered by Consul O'Neill in the end of 1883. Here Mr. Last will establish himself, and make a detailed study of the whole region in all its aspects. He will make a complete survey of the surrounding country, its topography, people, botany, economic products, climate, and languages. When this is completed, Mr. Last will enter the valley of the Likugu River, which rises in the neighborhood of these hills, and follow it down to the coast at Quizungu, whence he will travel south to Quilimane, or north to Angoche, and thence to Mozambique. Mr. Last will make a special point of collecting all possible information concerning the country he passes through, its changes, its people, their customs, languages, etc., the climate, its sanitary conditions, and its suitability for the introduction of European and other economic plants. The Lukugu valley is said to be very thickly populated, and must therefore be unusually fertile, and so of interest both to the colonist and the trader.

— The fact that sheet-lead in storage-batteries decays very soon, is a serious drawback to its use; and Dr. Kalischer recently described a secondary battery before the Physical society of Berlin, in which iron was used as the anode, and a concentrated solution of nitrate of lead as the electrolyte. The iron, on being immersed in the lead solution, becomes passive, and resists corrosion in the liquid. When a current is sent through the cell, peroxide of lead is deposited on the anode in a firm mass all over it. When nearly all the nitrate of lead is decomposed, there is a greater liberation of gas at the anode. The development of gas is to be avoided at the beginning of the charge: otherwise the peroxide of lead, or, strictly speaking, the hydrated peroxide of lead, becomes covered with bubbles of the gas. A cathode of sheet-lead is employed; but, to prevent it short-circuiting the cell by sending out lead shreds in charging, Dr. Kalischer amalgamates it, — a precaution which also saves the lead from corrosion by the nitric acid left in the cell after separation of the lead. The electromotive force of this cell is about 2 volts to begin with, but after six hours' discharge it falls off to about 1.7 volts. On leaving the cell at rest for twenty-four hours, it is found to recover some of the electromotive force lost. An attempt to substitute sulphate of manganese for nitrate of lead in the battery did not answer the purpose.

— The German New Guinea company, at the head of which stands Herr Adolf von Hausemann, has received an imperial charter dated May 17. The charter covers the following limits: 1. That part of the mainland of New Guinea under neither English nor Dutch supremacy. This district, called by permission Emperor William's Land, stretches from 141° east longitude (Greenwich) to the point near Mitre Rock cut by the 8° south, stretching thence south and west to where this parallel is cut by the 147° east longitude, then in a straight line north-west to where the 6° south latitude crosses 144° east longitude, and farther in a north-westerly direction to where the 5° south latitude crosses the 141° east longitude, then in a straight line north to the sea again. 2. The islands of this part of the coast of New Guinea, also the archipelago hitherto called New Britain, now to be called the Bismarck Archipelago, and all other islands north-east of New Guinea between the equator and the 8° south latitude, and between 141° and 154° east longitude. The company is made responsible, under imperial supervision, for keeping order within these limits, with right of possession, subject to previous agreements and treaties with the natives.

SCIENCE.

FRIDAY, JULY 24, 1885.

COMMENT AND CRITICISM.

Among the college assemblies of this season of the year, the most unique is that of the Convocation of the University of the state of New York. The organization of that body is so peculiar as to be hardly understood in other states, and a word in respect to it may interest our readers. The regents of the university are charged by the state with certain functions which pertain to the control of the academies and high schools of the state, and with a mild oversight of the universities and colleges. Once a year the regents invite the heads of all these institutions, and representatives of the faculties, to assemble in the senate chamber in Albany, and discuss such subjects as may be of special importance to the educational concerns of the state. This is known as the Convocation. Formal papers are read, addresses are made, and deceased teachers are commemorated; but probably the most useful feature of the gathering is the discussion of selected topics by appointed speakers, in the presence of a company of specially interested auditors. For example: at the convocation on the 9th of July, the chancellor of the university left the chair, which was taken by the president of Hamilton university, who introduced the topic of the day, — college discipline. The theme which he opened was discussed by the heads of several other leading institutions in the state. The contrast between such an educational conference and the great conventions of teachers is very marked. The talking is not for the outside public, though anybody may be present who wishes, and the reports in the newspapers are very brief; but the parties interested learn to know one another. They compare their views as experts, and give and take suggestions as to the theory and practice of the work with which they are charged. No mercantile element is allowed; or, in less euphonious phrase, no book-agents are allowed any privileges in these assemblies.

Our readers are well aware that early in June the memorial statue of Charles Darwin, by Boehm, toward the erection of which popular contributions were received from many lands, was unveiled in its permanent site in the great hall of the new natural-history museum of South Kensington. An appropriate address was delivered on that occasion by Professor Huxley, president of the Royal society. We refer to the subject again for the sake of calling attention to one incidental but not unimportant feature in the ceremony, — the presence of men from almost all parties and shades of religious opinion among English protestants. The appearance of the Prince of Wales, the Archbishop of Canterbury, the Dean of Westminster, Mr. Beresford Hope, Archdeacon Farrar, not to name any others, is enough to show that the 'establishment' is not unwilling to honor the great naturalist of our age. When the obloquy encountered a few years ago by 'Darwinism' — obloquy not yet entirely dormant in some portions of the United States — is borne in mind, the list of those who assembled on this occasion is as gratifying as the statement that contributions to the memorial were received from fifteen countries, besides the three kingdoms and the British colonies.

An unfortunate controversy has arisen in the ranks of the medical profession of this country with respect to the meeting of the ninth International medical congress. It is a controversy, however, in which all scientific men among us are interested. Indeed, the good name of American hospitality is involved in its settlement. The International congress, which meets triennially, had determined to meet in Washington in 1887. It is an asso-

ciation of the highest character and dignity, the meetings of which, for many years past, have been attended by the ablest men of the profession. Great benefits, as well as great pleasure, were anticipated from their assembling in this country. The American medical association, having a national name and a national constituency, appointed a select and judicious committee of arrangements; and this committee, having made good progress in their plans, and having secured the promises of co-operation from a large number of the profession, reported what they had done to the American medical association at its recent meeting in New Orleans. The report was received with unexpected disapprobation, in which it is not too much to say that personal and geographical jealousies were apparent. Another committee was appointed, which subsequently met at Chicago, and 'upset' nearly all that had been done so carefully by the first committee. Now, it appears that the first committee, though its work was 'upset,' commands, in fact, much more confidence from the profession than the second. The gentlemen invited by the new committee to co-operate have begun forthwith to make excuse. In Washington, Baltimore, Boston, and Philadelphia, — and perhaps in other places from which we have not heard, — men of the highest professional standing and personal character decline to act with the revolutionary party. Their cards have been made public, and have begun to attract attention from the daily press.

It now looks as if the revolters would not command the situation. Certainly men of eminence abroad will be slow to accept an invitation to an international congress upon this side of the Atlantic, if a large number of the most eminent physicians snd surgeons of this country, widely known professionally as well as personally, have been treated with discourtesy in the preliminary arrangements, and are therefore compelled to stand aloof. It does not look as if the new committee could enlist the general co-operation essential to success, and particularly because their authority is exercised in what appears to be the spirit of hostile reflection upon measures already initiated, against which no good objection has been made. The only solution of the problem seems to be, for the second committee to acknowledge their inability to form a government, and stand aside, allowing the original committee to go forward and perfect their plans, either in the name of the American medical association or in the name of the profession at large, by some concerted action, which there is time enough to mature. The latter alternative seems to us most likely to be successful.

During the past decade, Professor Elias Loomis of Yale college has read a series of twenty-one papers, entitled 'Contributions to meteorology,' before the National academy of sciences. The material for these studies has been drawn largely from the publications of the signal-service, and especially from the daily weather-maps, which now present so great an accumulation of observations that extremely accurate conclusions can be drawn from them. The results thus gained, as published in the *American journal of science*, constitute the chief source of generalized knowledge that a student can now consult concerning the behavior of cyclonic storms in this country, on which daily weather-changes depend so largely. The work has been throughout characterized by careful and discriminating methods, and forms as excellent an example of inductive research as can be placed before a student for a model. When put together, the 'contributions' now make a considerable volume, and form a fitting sequel to the early papers on the same subjects, written by Professor Loomis nearly half a century ago.

In the recent report of the Yale-college observatory, Dr. Waldo complains, and apparently with great justice, that the legislature of Connecticut, at its last session, suddenly terminated its contract with the observatory 'for time-service' to the state at large. He says that this action was taken without a hearing

from the railroad commissioners, the manufacturers of clocks and watches, the mayors or other authorities in the cities of the state, the telephone and telegraph companies, or the observatory. He states that no reason for this action was given except economy; and he claims that the observatory should be at least reimbursed for the considerable expense which it had incurred in preparation for this service. Unless there is some reason for the action of the general assembly not apparent to us, its conduct is certainly most discreditable to a state so intelligent and so wealthy as Connecticut. Nobody can believe that the moderate charge upon the treasury, in return for a service of such universal advantage, can have been burdensome. It is more likely that the action was due to a lack of acquaintance with the points involved, or to the prejudice of some individual. It is remarkable that a state which may almost be called 'the land of the clock-maker' should by its official action throw contempt upon accurate time-keeping. Such 'jerky' legislation is what the state universities of the west are wonted to, but nobody expected it in a matter like this from the land of steady habits. The first of steady habits is fidelity to an engagement, real or implied; and the second is like unto it, — punctuality in all matters where time is an element in the obligation.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Untimely death of a chipping-sparrow.

THE following tragic event occurred in the village of Wake Forest on the 15th of June. The nest was near completion: the lining of hair was being put in. Somehow, in the midst of this process, the sparrow's head became entangled in one end of a long horse-hair, the other end of which had been securely woven into the bottom of the nest. When he rose to go, the half-knot tightened round his neck, and poor chippy was found dangling some twelve inches below the nest, hung by the neck, and quite dead. I am told that a similar event occurred here a day or two after that stated above. In this case, however, the sparrow was hung by a cotton string, and was found so soon after the mishap, that he was released, having suffered little harm.

W. L. POTEAT.

Wake Forest college, North Carolina.

The Washington monument, and the lightning stroke of June 5.

By one who was near its base, the stroke of lightning which injured the Washington monument is remembered as a ball of fire coming towards him. Does not this observation explain the ball of fire so often reported? An electric spark passing between two points, will, to a circle of observers, present various appearances. If two inches long, it will be seen as a line of fire two inches long by some, while to those in the line of its motion it will be a single spark. So when a flash of lightning (a line of fire) is directed toward the observer, it must appear as a ball of fire, motionless if the movement is directly toward the observer, moving with comparative slowness if slightly off that direction, and with electric rapidity if across the field of view at right angles with the line to the observer's place.

M. C. MEIGS.

Washington, D.C.

Volcanic dust east of the Rocky Mountains.

My attention has recently been called to the interesting letter of Mr. George P. Merrill in *Science* for April 24, on 'Volcanic dust from south-western Nebraska,' and his subsequent paper on the same in the Proceedings of the U. S. national museum, 1885, pp. 99, 100. Since Mr. Merrill seems not to be aware of any earlier published notice of similar volcanic dust found east of the Rocky-Mountain region, a short note may not be amiss here.

In October, 1882, my friend and colleague, Mr. Samuel Garman, placed in my hands for examination a fine gray sand found in Dakota. This, on examination, was seen to be composed of volcanic glass in shards, tubes, etc., mostly water-clear; but a few forms contained glass inclusions and vapor cavities. A few grains were brown, like many of the rhyolitic glasses; many were ribbed, or thicker on one side, thinning down to an edge on the other; others were apparently of uniform thickness; and none gave evidence of being wind or water worn. A very little earthy material was found mixed with the volcanic ash. Mr. Garman gave an account of this deposit of glass before the Boston scientific society, Nov. 8, 1882, and a notice of it was published in the *Boston transcript* for Nov. 10. Attention was further called to this glass in my 'Lithological studies,' published early in November last, on p. 17. Mr. Garman has given me the following information regarding the deposit: —

"It was found about fifty miles south by east from the Black Hills, between the Niobrara and the White rivers, just north of the watershed, not far from the head of Antelope Creek. The bed is horizontal, and, as I remember it, nearly two feet in thickness at its thickest portion, and several rods in extent. The deposits in the immediate neighborhood are late tertiary. A small stream had cut away the bank in which the glass lay, exposing a considerable portion of it. From the exposed edge the powdery material is carried away by the wind as a fine, smoke-like dust. The glass in the bed is as clean as in the sample, except near the upper and lower surfaces, where it is mixed with other matter. To be so clean, it must have been deposited by water almost free from other impurities, for the winds would have mingled other dust with it."

M. E. WADSWORTH.

Museum of comparative zoölogy, Cambridge, Mass., July 9.

HUMANISM IN THE STUDY OF NATURE.

In a liberal education we must hereafter recognize a twofold division of our labor. On the one hand will be placed those studies which serve the purpose of humanizing the youth, i.e., of bringing him into a state of sympathy with his fellow-mortals; and, on the other, the studies which will serve to give the required measure of knowledge concerning the unhuman world,—the realm of physical and organic nature. The great profit of the present discussions concerning education has been found in the fact that it has brought this dual character of the work of education clearly into view.

What, however, has this lower world of facts to give, that can be of such value that the student is told to turn from the field of man for its study?

We will pass quickly by the commonest argument. Unhuman nature, say many, concerns us because we have to live in it: it is a great engine, whose power may grind our grists, or whose merciless wheels may crush out our lives. Master its movements, that you may have power at your command; keep your frail self from its dangers, that you may live long. This is the way that some look upon the outer world. It is a sensible view, but in itself it little concerns the problem of education. From this point of view, nature is for the economist, for the practical man.

But for the purposes of a general education, the realm of nature beyond human interests should be approached with the view, first, to get some sound general idea of the construction of this realm, and its relations to the life of man in the largest sense of that life; next, to secure some clear sense of the nature of scientific evidence; and, lastly, to gain an idea of the order and control which exists in the extra-human world.

Purely human education is deficient in perspectives: it finds man as man; it considers his relations to his fellows, and leaves him separated from the universe, alone amid a world of physical and organic life. But to secure a sound understanding of man's place in nature, we must give the student some general ideas as to the ways of that nature.

This end should be secured by studies which begin with the human body and its functions, and afterwards extend progressively farther and farther away. We have thus the help of the human interest which surrounds our own personal affairs, and extends, through immediate sympathy, to the lower world of living things. The elements of human anatomy and physiology should be the first thread to guide the student to the world beyond man. This may profitably lead to the study, in outline, of organic life below man,—a study which should aim at a clear understanding of a few lower animals and a limited number of plants. After the student has some accurate knowledge of the bodily parts and functions of a cat, a bird, a frog, and a fish, his mind is prepared to receive a little general truth given in words concerning the vertebrated animals. In the same way, an insect, a lobster, and a worm will give the basis for understanding the articulate animals; a snail, a clam, and a squid will show him his way to an understanding of the molluscan affinities; and so on. In the plants, a seaweed, a fungus, a fern, and an ordinary flowering plant, will, if well known, serve to make real a great many important general facts which have to be presented in a didactic fashion. In this teaching, constant effort should be made to give the matter a human interest by referring to man's body and habits, or his physical relation to the lower world, for comparison or illustration.

The next step will necessarily take the student into the realm of geology, or earth-history. Here the world of our day should be shown with especial reference to its relations to human life and its development. It is easy so to knit the considerations of the existing conditions of the earth with the interests of man. Over the bridge of human sympathies we may easily find a way for the student into the wider realm of the world-life. Climate may be studied with reference to human history, or the geographical distribution of organic beings, including man; volcanoes and earthquakes, with reference to their effects on the life of our species: so nearly every department of the earth's history may be made to have a relation to the natural human interests which the child brings with it to the study of the outer world. I know that there are those who will object to the anthropocentric, the over-humanized view of nature which this form of teaching tends to inculcate; but to the mass of men this is a necessary way of looking at the world. The worst failures in teaching science have come from a neglect of the all-important fact that nature is to most minds only interesting because of its relations to man. It may be—but may a merciful Providence defend us from the evil—that in time many children will be born to whom crystals are as interesting as human lives, and a geological period as full of

charm as the best age of Greece. To the specialist the remotest problems of science, doubtless, come to have living interest, become a part of his life, in fact; but they are not so to the beginner.

After some sense of the present conditions of the earth's surface is gained, the youth may be shown the evidences of the earth's past. It is particularly desirable that this inquiry into the old conditions of the earth should be so made as to aid the student to conceive the antiquity of the earth's past. This conception of past time is the most difficult to form of any of the large understandings of nature, while at the same time it is the most enlarging idea that can be obtained from geology. It gives much that will re-act on the youth's understanding of human history. If on viewing the slow gain of man in his progress from age to age, the persistence of evil beneath the guise of changed manners, and the inevitable sinking into the pit which seems in time to overtake all peoples, there comes to the student that sense of helplessness which so often assails the most ardent believers in the future of humanity, the geologic past has consolation for him. There he sees that 'one eternal purpose runs' through all those ages, and that the very catastrophes which seem to bring temporary ruin are but the steps to new life. Even more valuable than this is the impression of amplitude of time, which the student needs to secure as the basis on which to rest all his understandings of nature. Measuring the progress of all events from the infinitesimally brief duration of human life, the student is prone to impatience with the slowness with which this march of the ages goes on. Give him a sense of the larger space of the earth's history, and we relieve the mind of this prejudice.

Beyond the realm of the earth, it is not worth while to try to do much. Astronomy has, however, some tolerably simple and most important lessons. Its greater truths are unfortunately only accessible through the way of rather difficult mathematics; but there are some conceptions which are to be obtained with little labor, and which should be won. The order of the solar system, and the relations of the several planetary bodies, should be within the compass of minds entirely unskilled in mathematics. The first of these relations to be studied should be that which is found in the revolution of the earth around the sun, and the concomitant effects derived from the increase and diminution of eccentricity of its orbit, the precession of the equinoxes, and the rotation of the apsides. With a small globe (or, as well, an orange), with pins to represent the poles, and a thread for the equator, a lamp on a centre-table to represent the sun, and a little exercise of limbs and wits in conveying the sphere around the table in a way to imitate the phenomena in question, the student can gain a clear conception of a most important series of relations. The student should then proceed to the work of extending the same order of conceptions to the other bodies of the solar system.

As in geology the student finds a profit in the expansion which the conception of vast duration forces upon the mind, so in the study of astronomy enlargement may be gained by the conceptions of space which are brought home to him in the study of that science. Neither geologic time nor celestial space can really be conceived by the mind; still, the effort to grapple with such immensities, though seemingly futile, is yet profitable. Especially if it be often repeated, this effort bears fruit in a sense of power which is given by no other mental exercise. Many things may give breadth to the mind, but among these widening agents the conceptions of time and space deserve high rank. It would be in a certain way true to say that we might get a measure of the greatness of a mind by its power to conceive a wide field of temporal and spacial relations. May we say that these measures enter the soul, and give it something of their dimensions?

We turn now to the use which we may make of nature when we seek to give the mind a conception of the relations of cause and effect, and the nature of evidence. The best field for such study is to be found in the department of physics and chemistry. There we may in many cases so isolate the phenomena we are examining, that they are uninfluenced by other conditions than those which can be perceived and taken into account. Studies in this field should begin with the phenomena of masses, with the effects of gravity, of momentum, and other actions where the facts are in the realm of tolerably familiar experience. Such personal experiences should be multiplied until the mind becomes habituated to the actions which it is contemplating. From this firm ground, studies should be extended to the obscurer phenomena of physics, or such as are found in those parts of the subject where the causes are invisible, as in the great field of electrical action. There the mind can become accustomed to the consideration of causes which are not only invisible, but outside of the limits of ordinary experience.

After some training in this department, the

student should next make acquaintance with chemical action. Here the aim should be to show the complication of laws which control the relations of bodies, molecules, and atoms, which entirely elude the senses. Nowhere else can the student so well attain to a conception of the penetrating influence of natural law or the infinite variety of its results. No other department of study will do so much to take away the idea of grossness, of inorganization, which the untrained mind applies to the world of matter. It is not necessary that the student should make much progress in analytic chemistry: the simpler the phenomena chosen for the study, as long as they involve the perception of quantitative relations, the better for this task. The main point to be attained is the comprehension of the principles of atomic and molecular relations, and an understanding of the nature of evidence as to causation, which this science, as well as physics, so well affords. Although the field to be gone over in these departments is not wide, it should be patiently and repeatedly traversed, in order that the mental effect should be clearly and firmly borne in upon the student.

We now come to the third end which we should seek to attain in our use of natural science in the work of education. This is the conception of the order and continuity which prevails in nature. In the lower states of human culture, we find the savage and half-civilized peoples looking upon the physical world as a domain which is under the control of superhuman yet essentially human persons. All the order and much of the apparent disorder of the outer world are accounted for by the control and the contentions of these superhuman powers. The advance towards monotheism gradually did away with this crude but natural conception of law; and in its place has come a dull, inert sense of the mere power of the physical universe, which has no educative value whatever, and which is in truth falser to the facts than the conception of nature held by the orthodox Greek of the Periclean age. In place of the old animism which humanized all parts of the universe by giving its control to powers which were akin in nature to, and in sympathy with, man, we have now a set of meaningless terms which cloak our want of understanding.

The first aim of education should be, if possible, to restore the old sense of close sympathetic relation to the outer world which was lost with the death of polytheism. To restore it on the line of our new and higher knowledge of the universe, man must in some way find himself in the world of physical life. Our monotheistic religion cannot do this work, for it turns the mind towards the infinite alone: it almost necessarily neglects the phenomenal world. Even the theory of design failed to lead men to the study of nature. Religion, in the proper sense of the word, concerns the moral side of man too completely to aid us in this task: if man is to gain a better reconciliation with the physical world, he must secure it on other lines.

The only possible way in which a real sense of kinship with the outer world can be aroused is through the sympathies, first by the sense of beauty in nature, next through the kindred sense of order or continuity of action in the physical world.

There is an instinctive progress towards this reconciliation which is brought about by the growing love of the beautiful in nature. It is hard to prescribe a way in which it can be fostered: it is not easy to do this work in the case of any sympathies; but the teacher will readily see that it is the most precious of all the means by which man can find his way to a more loving relation with the outer world. When the teacher of natural science can create or deepen the sense of the beautiful and the ordered in nature, he has done his work as minister in this great need.

In close relation to this sense of beauty is the sense of order in physical and organic nature. The teacher should endeavor in all ways to give the pupil a sense of the absolute continuity of action in the world. This difficult conception is perhaps best obtained by presenting the evidence that man is, at least in his body, the product of a continuous life, which, from the earliest ages to the present day, has gone step by step upward. Let the student grasp what he can of this overwhelming truth; let him see how, through all the accidents of this perturbed world, the life which has led to himself — his life, in fact — has gone unfalteringly forward to its end. We thus give him a feeling of his kinship with nature, — a sense of a kindly filial relation to the earth which will widen and deepen all the ways of thought.

Thus, without going very far beyond the theory of a thoroughly humanized education, without demanding more than one-third the schooling-time between the ages of ten and twenty, it will be possible to give the youth all the training which is necessary to secure the best that scientific culture can afford.

N. S. Shaler.

AN ARIZONA NATURAL BRIDGE.

DURING a visit to Arizona, I came across a natural bridge, an account of which may be of interest in connection with recent notes on the Virginia bridge.

A long ridge, about six hundred or eight hundred feet high, extends for some distance north from a point near which the Atlantic and Pacific railroad crosses the boundary between New Mexico and Arizona. This ridge is formed by strata of dark-red sandstone under light-red, and is capped by a stratum of fine conglomerate or coarse grit. These strata are broken, and present an abrupt and generally perpendicular face to the west, sloping at an angle of 14° to the east, with the course of the stream, until they bury themselves below the alluvial sand. There are lower ridges, of corresponding structure, parallel to this on the east and west. This ridge is cut by deep and narrow cañons. At the mouth of one of these cañons, just before it dips under the sand, occurs this bridge. It is about twenty miles from the railroad, and, as far as I know, has never been visited by white men. I was guided to it by my Indian scout. The cañon extends west for about five miles above the bridge, and becomes deep, narrow, and wild; the sides, with their growth of hard-wood and pine, almost cutting off the light at mid-day.

The bridge is formed by a remnant of the overlying grit, which is continuous with it on both sides. The section cut through beneath it is of light and dark red sandstone, the former showing very pretty cross-bedding, and is non-conformable to the latter, which has much less dip. The bridge is sixty-five feet long, and fifteen feet wide at the narrowest point. It is two feet thick in the centre, and fifteen feet at the sides. The illustration, from a photograph taken at the time, will give a good idea of the position and proportions of the bridge; our ponies, standing underneath, serving for comparative measure. It will be seen that the cañon is wider for a short distance above the bridge, which may be due to a tributary cañon at that point.

It is difficult to give an explanation of this curious phenomenon; and I shall only suggest a possibility, in the hope that some one will find time to investigate it more thoroughly. If above the present grit there had been soft strata, capped again by grit, it might be explained on the principle of the Swiss pot-holes; a waterfall being formed above, which wore a hole through the lower grit, and so undermined it, and cut out the sandstone beneath, as at Trumelbach. But the grit has every appearance of being a continuous cap over the ridge. The grit shows, however, evidence of an inclination to break into blocks; and it may be that a large crack, thus formed to the west of the present bridge, allowed the stream to reach the soft sandstone, and so cut it away beneath.

A short distance off is another curious but not so uncommon phenomenon, — a 'petrified forest.' The stone tree-trunks lie just beneath the soil, or half exposed, fallen in all directions. I procured specimens which showed the bark, knots, roots, and branches. The radiate arrangement of the wood-cells was very evident in some cases. There are a number of these 'petrified forests' in Arizona, I was told. I know only of one other on the Navajo reservation, and one near Flagstaff.

FREDERICK GARDINER, JUN.

THE RECENT AGRICULTURAL CONVENTION AT WASHINGTON.

Pursuant to a call issued by the commissioner of agriculture in May last, a convention of agricultural colleges and experiment-stations was held in Washington on July 8 and 9. The meeting was well attended, some thirty states and territories being represented by nearly fifty delegates; and the deliberations of the convention were marked by a noteworthy spirit of harmony and earnestness.

An informal gathering of the delegates in the parlors of the Ebbitt House on the evening of July 7 served to increase their acquaintance with each other and the commissioner of agriculture, and to outline a plan of organization for the convention.

The meetings of the convention were held at the Department of agriculture. At its first meeting, on Wednesday morning, it was organized by the choice of Hon. Norman J. Colman, commissioner of agriculture, as president; Presidents Willets of Michigan, Lee of Mississippi, Atherton of Pennsylvania, and Fairchild of Kansas, and Professor Dwinelle of California, as vice-presidents; and President Fairchild of Kansas as secretary.

The opening address of the commissioner occupied nearly an hour, opening with a review of the history of the land-grant colleges, but mainly occupied with suggestions as to how these colleges may attain to greater usefulness and success. The speaker regarded agricultural experimentation as being at present one of the most important and profitable functions of agricultural colleges; and the two thoughts most prominent in the address, as well as in the subsequent proceedings of the convention, were the need of a more generous financial support for this work, and the desirability of establishing more intimate relations between the U. S. department of agriculture and the several state institutions devoted to the furtherance of scientific agriculture.

The first business of general interest brought before the convention was a resolution introduced by the committee on order of business, approving the principle and general provisions of the bill to establish experiment-stations in connection with the agricultural colleges, introduced into the last congress, and known as the Cullen bill. The resolution was supported by Col. Switzler of Missouri in an eloquent speech, and also by Professor Knapp of Iowa, President Smith of Maryland, and Professor Cook of New Jersey, and was adopted by an almost unanimous yea and nay vote, only three or four delegates being absent, and no one voting nay. Following this, a committee of three on legislation, consisting of Presidents Atherton of Pennsylvania, Willets of Michigan, and Lee of Mississippi, was appointed to act in conjunction with the commissioner of agriculture in endeavoring to secure from the next congress legislation on this subject. Subsequently a general committee of one from each state was appointed, one of the duties of which was to endeavor to bring public opinion to bear upon this question, and to secure the votes of their respective states for the measure.

Upon the important subject of the relations which should subsist between the department of agriculture and the agricultural colleges and experiment-stations of the country, the convention expressed itself with a commendable degree of moderation. It is sufficiently obvious, to any one who is practically acquainted with conditions of experimental work, that the dreams of certain enthusiasts who would like to see this work organized with almost military rigor, under the direction of a central authority at Washington or elsewhere, can never be realized until human nature undergoes a radical change. Men who are competent to plan and carry out original investigations will not consent to lose their individuality, and become parts of a machine, however well constructed. The convention wisely recognized this fact, and confined its recommendations to the establishment of a 'bureau of correspondence and exchange' in the department, to serve as a means of communication for the several colleges and stations with each other and the department. It is intended that this bureau shall act as an agent in the exchange of reports of experiments, and also that it shall publish at regular intervals a summary, couched in popular language, of the results of investigations in this country, and possibly also in foreign countries. To aid in accomplishing the latter purpose, those present agreed to furnish the commissioner of agriculture, when called upon, with the results of experiments conducted at the institutions represented by them.

Commissioner Colman entered heartily into the plan, and agreed to carry it into execution as fully as the funds at his disposal would permit; and it is due to him to say, that, in all the proceedings, he showed a hearty desire to co-operate with the convention in carrying into effect any plan deemed wise by it, and exhibited not the least spirit of dictation or desire for the undue aggrandizement of his department.

Very plain language was used by several speakers to characterize the present methods of seed-distribution; but nearly all agreed in recognizing it as, for the present, a necessary evil. The commissioner announced, however, that he hoped to secure a special appropriation from congress for the purchase and distribution of seeds and plants from foreign countries, and that, if he were successful, he desired the co-operation of the agricultural colleges and stations in testing them in different regions of the country. This proposition met with the hearty and formal approval of the convention.

In addition to these matters, various subjects of minor importance were considered; and a very interesting discussion was had upon industrial education, opened by a paper by President Willets.

While the final success of the convention will be judged by its results, as a meeting it was eminently satisfactory; so much so, that it was unanimously voted to continue the organization by the appointment of a general committee of one from each state, as already noted. From this general committee, an executive committee of six was chosen to arrange for another convention at the proper time.

SIR PETER LUMSDEN ON THE TRIBES UPON THE AFGHAN BOUNDARY.

IN speaking before the Royal geographical society of London on the 22d of June last, on the country and tribes bordering on the Koh-i-Baba Range, Sir Peter Lumsden, the chief of the Afghan boundary commission, on the part of England, said that on the 25th of November last the commission crossed over the Koh-i-Baba Mountains by the Chashma Saby Pass; and in drawing attention to the country, and to the tribes inhabiting the slopes of this range, he proposed to confine himself to the relation of such matter as had not hitherto been brought before the public. Touching, at the outset, on the difficulties presented to the geographer in such a region, he pointed out that to us, happily ignorant of all the horrors involved in the dreaded 'Alaman' or Turcoman raid, a map of a country swept by these raids is difficult to comprehend. In such a district names do not signify towns or villages, but merely the sites where they once existed, marked, perhaps, by mounds delineating the ground-plan of forts, *caravansérais*, houses, or tanks, but of which no other traces now remain. Of the former inhabitants, frequently the only records are the tombstones of their burial-places, from some of which data may be secured in marking the period when they were swept into slavery or destroyed. For instance: in the tract of country between Gulran and the Kushk River, the last inhabitants were Usbeg and Hazara, and on the tombstones of their dead were dates extending as nearly as possible over a century; viz., from A.D. 1650 to 1750. Another difficulty to the geographer is that there are generally two names for each stream or location, — the first, the traditional one, known to Afghan and Persian, and frequently of Arab or Persian origin; the second, that by which it may be known to the Turcoman shepherds or sirdars, who alone traverse these little-frequented routes. Along the northern base of the Koh-i-Baba are a succession of fertile valleys, through which run streams formerly used for irrigation purposes. The marks of water courses point out the lines of ancient channels, while in many places karezes (that is, subterranean canals) indicate a state of past prosperity and extensive cultivation. Towers and walls of still existing forts show, that, even in those far distant days, property required protection; and, as on the site of the old castle of Gulran, the skulls and skeletons scattered over it seem to indicate that indiscriminate slaughter must frequently have attended the destruction of local cities long since untenanted. At Bala Murghab, Karawal Khana, Meruchak, and Penj Deh, besides in several other places, there are foundations marking the existence of former permanent bridges across the Murghab; and extensive re-

GATEWAY OF BALA MURGHAB. (Ill. *London graphic.*)

mains of large towns at Penj Deh, Killa-i-Maur, Meruchak, and Karawal Khana indicate a state of prosperity once existing in these valleys which has long passed away.

Passing from the physical features of the country to describe the character and mode of life of the population, he said there was a marked difference between the Afghans and Turcomans. In Penj Deh, the principal valley of Bagdis, they scarcely ever saw an armed man, and found the Sariks, instead of being the dreaded alaman-sweeping and slave-dealing people they came to see, an industrious, hard-working race, at that time busy from morning to night in the excavation and clearing of their canals, always moving about with a spade having a somewhat triangular-shaped blade continually across their shoulders. The Sariks were stalwart men of good physique, resembling very much in character the Turks. A shrewd, hard-headed, practical people, they continually expressed their desire for security and permanent settlement. These Sariks, along with their brethren of the Tekke, Salor, and other Turcoman tribes, had been for a century the scourge of northern Persia: they had swept the inhabitants away from valley after valley down the Hari-Rud, almost as far as Seistan and westward, within a hundred and fifty miles of Teheran itself. From the slave-trade and plunder secured in these raids they had amassed comparatively great wealth, and they certainly seemed better off than most Asiatic races. The slave-trade and raiding having been entirely abolished, owing to the action of Russia and the closing of the markets, these Turcomans now eagerly seek for a source from which they can secure wealth, and maintain their present prosperity. They own great herds of sheep, amounting in 1884 to an aggregate of 194,250, divided into flocks of from 700 to 1,500 each. They have hitherto generally disposed of their sheep in the Bokhara and Oorgunj markets. On the spot the price of sheep is from 4 s. to 8 s. 6 d., according to age and quality, the latter sum being the price for a four-year-old; camels fetch about £6 10 s.; horses, from £13 to £25; bullocks, £2 10 s. to £3; cows, £2 to £2 10 s.; and goats, from 4 s. 6 d. to 6 s. With regard to the Turcoman horses, the conclusion arrived at by the officers with him, and he believed also by the Russians, was that the Turcoman horse has altogether been overrated, and that in many respects he is inferior to the numerous herds bred in more mountainous tracts, such as the Kuttighanie of Afghan Turkestan. The Turcoman women do a vast amount of work: they fabricate carpets, purdahs for doors, work-bags, horse-clothing, nummads, and blankets; and, when a young woman is engaged, it is thought to be the right thing for her to work all the kibitka domestic carpets and other household requisites before she is married. When, however, they do marry without having completed this task, it is expected from them, that as soon as practicable, by their own labor, they may refund in cash or kind, to their husbands, the dowry paid to parents on marriage. Such dowry generally consists of 100 sheep and 40 tillas, which the bridegroom either pays down in a lump sum to the parents of the bride or by stipulated instalments. The trade of Penj Deh is carried on entirely by Jews, of which there are some twenty families settled here: they are offshoots from the Jewish colony at Herat. They number something like three hundred and fifty families, and have in their hands most of the trade with Balkh, Bokhara, Khiva, and Merv.

Jamshedi. Hazara. Sarik Turcoman.

SOME TYPES OF AFGHAN TRIBES. (Ill. *London graphic*.)

After quoting copious extracts from Capt. Maitland's description of the hitherto little-known tract lying between the Murghab and Hari-Rud Rivers along the Gumbegli route, as well as Capt. Yate's account of the interesting natural feature of the Nomaksar, or salt lakes of Yar-oilan, he summed up by saying that the country was one capable of great resources. The climate is good; the winter is cold; and great storms are not unfrequent during the winter months, indeed the commission experienced one as late as the 2d of April; the spring and autumn, however, are beautiful; and the summer, though hot, is nothing to the extremes of heat to which one is accustomed in the plains of India. It is possible even to live in tents, or kibitkas; and, under the shelter of a roof, such luxuries as punkahs would be superfluous.

With a settled government and increased population, there is no reason why this should not become one of the most prosperous tracts of central Asia.

GEOGRAPHICAL NOTES.

THE fifth expedition of the Belgian international African association, which started with the view of connecting by a chain of stations the east coast with the interior basin, has returned, the expense proving too great to render the project profitable. The Zanzibar agent of the society has returned to Europe. The efforts of the association at present will probably be confined to the Kongo watershed.

The death of Mirambo, the noted chief of Unyamuezi, is confirmed. His principal rival, Kapira, is also dead. The power of the former was so great an element in securing peace and security of travel, that his death seems a public misfortune. The son of M'tesa is reported to have succeeded his father. He is young and intelligent, and favorably disposed toward Europeans. He was for several years a pupil of Father Levinhac, recently consecrated bishop of Uganda.

Lieut. Hovgaard intends to visit the east coast of Greenland next year at the expense of the Danish government. Herr August Gamel, the owner of the steamer Dimfna, has placed it at his disposal. The majority of copies of the work known as 'Meddelser om Grönland,' published by the Danish government, and which received one of the annual medals of the Paris société de géographie, were burned in the recent conflagration at the palace of Christianborg in Copenhagen.

Caspari has reported on the station of Sheik Said at Cape Bab-el-Mandeb, claimed by France. It appears to be a desert spot, with an exposed roadstead, severe heats, no vegetation, and the fresh water scarce and bad. There is a shallow lagoon containing many fish, out of which a small community of Arabs manage to gain a living. Altogether it would seem a most unpromising spot for a European colony.

La société des études historiques, Paris, offers a prize of one thousand francs, or a medal of equal value, to the author of the best memoir on the following subject: "A study of the consequences, from the point of view of political economy, of the new relations between Europe and West America, eastern Asia and Polynesia, which would follow the completion of the Panama canal." For conditions, competitors should address M. L. Racine, administrator of the society, 62 boulevard de Courcelles.

Assan Khan Saniéduleh, minister to the shah of Persia, has sent to the Paris geographical society a memoir on the district and town of Maybaud, another on the region of Kelat-i-Nadiri, with a map, and the first volume of a series of three, to be devoted to Khorassan, all in the Persian language.

A steamer called the Industrie, of 513 tons, has arrived at Cologne, March 18, being the first vessel to enter that port direct from an ocean voyage. It is expected that she will prove the forerunner of an important commerce.

The missionaries of Uzigay in the equatorial lake region of Africa report that the use of a sort of beer made of bananas has been used by them with excellent results as a prophylactic against malarial fevers. Owing, as they suppose, to its use, they have enjoyed in that pestilent region the best of health. The matter seems worthy of investigation.

Teisserenc de Bort writes, that, midway between Khurd-Rumed and Beresof, his party had discovered a depression called by the inhabitants Sebkha Zeita, six or eight kilometres in extent, which forms a lake during the wet season. It is surrounded by an almost circular chain of dunes, between which and the lake are found very numerous chipped flints and other vestiges of man, including hundreds of hearths where the stones show traces of fire.

ASTRONOMICAL PROGRESS IN 1884.

PROFESSOR NEWCOMB contributes to vol. ix. of Appletons' annual cyclopaedia, just published, an interesting article on 'Astronomical phenomena and progress during the year 1884.' In observatories and instruments, he notes the completion of the Lick observatory, with the exception of its equatorial; and the mounting of the great telescopes at the University of Virginia and at Pulkowa, the latter of thirty inches aperture, the largest refractor yet made. In solar physics, Langley's Mount-Whitney work receives first attention, and the tardy appearance of the sun-spot maximum in 1884 (one or perhaps two years behindtime) is remarked. From recent determinations of the velocity of light, the solar parallax is found to be 8.794", and the corresponding distance of the sun, in round numbers, 93,000,000 miles, "which is not likely to be altered by much more than 100,000 miles by any future discoveries."

Recent observations on Jupiter appear to show that the period of rotation at its equator is more than five minutes less than in the latitude of the great red spot, — a result which is of great interest, as tending to confirm the suspected resemblance of that planet to our sun. Saturn, during the winters of 1884, 1885, and 1886, is in an unusually favorable situation for observation; and we may expect valuable testimony on the disputed variability of the rings, and on the many interesting physical phenomena which the planet presents. The asteroids and comets of the year receive due notice. Attention is called to Professor Pickering's inventions in photometry, which have provided us with a standard catalogue of the magnitudes of over four thousand stars, — 'Harvard photometry.' By a very elaborate calculation, Professor Oppolzer has investigated the question whether the excess of the moon's apparent acceleration above its computed value may not arise from the mass of the earth being gradually increased by the falling of meteors upon its surface. He concludes that a precipitation of cosmic dust of about

one-thousandth of an inch in a year would account for the difference. In stellar parallax we find the important work of Gill and Elkin at the Cape of Good Hope, and the surprising results of the Pulkowa observations, which, if confirmed, will place the star Aldebaran among the three or four nearest of the fixed stars. Professor Newcomb mentions the spectroscopic investigations of the motions of stars in the line of sight, observations of the companion of Sirius, cataloguing stars by photography, and the red sunsets, and concludes with a review of the conclusions of the International meridian conference, and a notice in regard to the communication of astronomical discoveries, and the recently founded Watson and Draper astronomical prizes.

WATER-SUPPLY FOR NEW YORK.

Mr. J. T. Fanning, who is well and favorably known to the profession by his valuable treatise on water-supply engineering, prefaces a study of the present and future water-supply of New York[1] by a couple of pages, giving a brief historical summary of the establishment of the Croton aqueduct, which at its opening in 1842 supplied the city, then having a population of less than one-third of a million, with an average of twelve million gallons of water daily. The history of the rapid increase in the consumption of water, next given, shows that by 1875 the demand for water had reached the limiting capacity of the aqueduct, which amounted to a daily average of ninety-five million gallons. Since 1875 "the public fountains have ceased, one after another, to flow. Drinking-fountains for either man or beast have been almost unknown of late in the public streets. Meters have been applied in charitable institutions, as well as in manufacturing establishments, and the most stringent measures taken to prevent waste, and at times most urgent appeals made to save the consumption, that the evils of an approaching water famine might be lessened." The New-York water department estimates that the works now in progress will draw from the Croton watershed a daily average of two hundred and fifty million gallons (see *Science*, No. 124).

On the basis of numerous statistical tables given in the report, as to increase of population and of water-consumption, the attempt is made to estimate the period during which these new works will provide a sufficient supply for the city, and for the population which must draw its water from the city supply.

In making this estimate, the needs of the city are taken to include a sufficient supply for the ordinary uses to which water is applied in our larger cities, not excluding those uses in manufacturing establishments for the lack of which business must be curtailed, or settle elsewhere.

The conclusion reached in this report is, that, before the year 1898, the regular increase of population and the expansion of business will require the whole of the projected average supply of two hundred and fifty million gallons *per diem*, and that before 1930 four times that amount may be needed.

Having thus determined that the total available supply from the Croton watershed cannot in any event answer probable legitimate demands for much more than a single decade, the author, in looking to other gathering-grounds from which to draw a sufficient supply for future needs, regards the head waters of the Hudson River in the Adirondack region as the most available source, provided the city is to be supplied by gravitation with water of unexceptionable quality, in adequate quantities, and at a pressure due to a head of two hundred feet or more above tide water, such as will carry water to the upper floors throughout the city.

Careful surveys show that a canal sixty feet wide, thirteen feet deep, and somewhat over two hundred miles long, would carry five hundred million gallons of water *per diem* from near Fort Edward to New York. The estimated cost of this conduit is nearly thirty million dollars; and the auxiliary structures, storage-basins, necessary tunnelling, etc., twenty-five million dollars: total, fifty-five million dollars. It is proposed that the canal run on the highlands east of the Hudson River at an initial elevation of three hundred and fifty feet above tide water, and that this source be also used as the water-supply for the cities and towns on both sides of the river, between Albany and New York, having, according to the census of 1880, an aggregate population of quarter of a million souls, besides the million and three-quarters in New York and Brooklyn. Detailed surveys and the statistics of annual rainfall show that the Adirondack watershed is capable of furnishing an average of nearly fourteen hundred million gallons daily without trespassing upon the river-supply available for canal and manufacturing interests.

This grand and beneficent project must evidently, before many years, be put in process of actual construction. It is greatly to be desired that the state of New York should, as soon as may be, put a stop to the destruction of the Adirondack forests, and reserve a principal part of that region for a park, thus preserving this region as a sanitarium for the commonwealth, as well as the source of a beautiful supply of good healthful water for the entire Hudson valley.

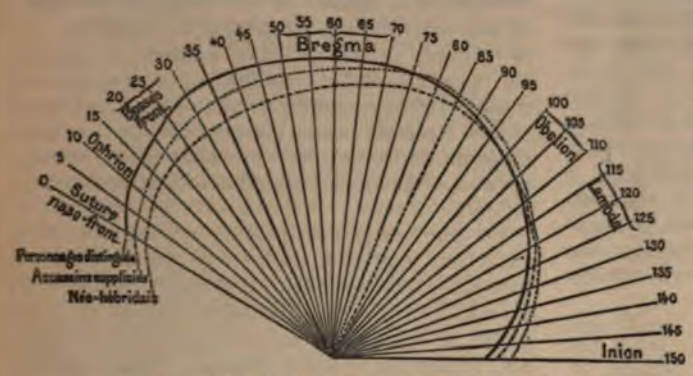
[1] *Report No. 2, on a water-supply for New York and other cities of the Hudson valley.* By J. T. Fanning, C.E. New York, 1884. 36 p., 3 maps. 8°.

COMPARISON OF THE SKULLS OF ASSASSINS AND MEN OF NOTE.

The material for Dr. N. Bajenoff's studies of the heads of assassins and distinguished persons (*Bull. soc. anthrop. de Paris*) was of two kinds, — first, fifty-five heads of assassins; second, nineteen heads of distinguished persons. This last series seeming too small, he prepared another, composed of the heads of twenty-five noted living men. His main studies were carried on by means of the cephalometer of Anthelme,

which is the only instrument that permits the drawing of a curve from a series of heads by taking for each ray the mean in the series. The mean curve for each series shows that all the frontal rays of distinguished men are much greater than in the assassin, and that in a savage race, the Neo-hebrides, taken for comparison from four heads, the frontal development is even less than among assassins.

These last two curves cross the first in the parietal part, in the neighborhood of the bregma; and the posterior development of assassin and savages is greater in all points than that of distinguished men. In all the distinguished men the occipital rays were less developed than in the other series, though this difference is less marked. The maximum rays, represented in the diagram by dotted lines, are in distinguished



AVERAGE MEASUREMENTS OF THREE CLASSES OF HEADS.

men at the 35° line, while in the other two classes it is found at the back of the head, between the 80° and 85° ray. This rule is not so infallible that we can pick out men, and say this is a distinguished man, this an ordinary man, and this a criminal, simply by the shape of the head; but it can be said that seventy-five in a hundred learned men have the superior character, while at least ninety-five in a hundred assassins have the inferior character. A third part of Dr. Bajenoff's work deals with the cranial projection (total, posterior, anterior, and facial) and the facial angle. These confirm his first experiments. Among distinguished persons the anterior cranial portions are the best developed, while among savages and assassins the facial and posterior projections exceed the others.

ORIGIN OF THE CEREALS.[1]

RECENT numbers of *Naturen* contain interesting papers, by Professor Schübeler, on the original habitat of some of the cereals, and the subsequent cultivation in the Scandinavian lands and Iceland of barley and rye more especially. It would appear that barley was cultivated before other cereals in Scandinavia; and that the generic term 'corn' was applied among Northmen to this grain only from the oldest times; and that in the Norwegian laws of the seventeenth and eighteenth centuries, wherever reference was made to the '*Kornskat*' (or standard by which land in the northern lands was, and still is, rated in accordance with the corn it is capable of yielding), the term was understood to apply to barley. Proof of the high latitude to which the cultivation was carried in early ages is afforded by the Egil's Saga, where mention is made of a barn in Helgeland (65° north latitude) used for the storing of corn, and which was so large that tables could be spread within it for the entertainment of eight hundred guests. In Iceland barley was cultivated from the time of its colonization, in 870, till the middle of the fourteenth century, or, according to Jón Storrason, as lately as 1400. From that period down to our own times, barley has not been grown in Iceland with any systematic attention, the islanders being dependent on the home country for their supplies of corn. In the last century, however, various attempts were made, both by the Danish government and private individuals, to obtain home-grown corn in Iceland; and the success with which these endeavors were attended gives additional importance to the systematic undertaking which has been set on foot by Dr. Schübeler and others, within the last three years, for the introduction into the island of the hardier cereals, vegetables, and fruits. As many as three hundred and eighty-two samples of seeds of ornamental and useful plants, most of which were collected from the neighborhood of Christiania, are now being cultivated at Reykjavik under the special direction of the local government doctor, Herr Schierbeck, who succeeded in 1883 in cutting barley ninety-eight days after the sowing of the seed, which had come from Alten (70° north latitude). And here it may be observed that this seems the polar limit in Norway for any thing like good barley-crops. The seed is generally sown at the end of May, and in favorable seasons it may be cut at the end of August, the growth of the stalk being often two inches and a half in twenty-four hours. North of 60° or 61°, barley cannot be successfully grown in Norway at more than from eighteen hundred to two thousand feet above the sea-level. In Sweden the polar limit is about 68° or 66°; but even there, as in Finland, night frosts prove very destructive to the young barley. In some of the fjeld valleys of Norway, on the other hand, barley may, in favorable seasons, be cut eight or nine weeks after its sowing; and thus two crops may be reaped in one summer. According, even, to a tradition current in Thelemarken, a farm there owes its name, *Triset*, to the *three* crops reaped in the land in one year. Rye early came into use as a bread-stuff in Scandinavia, and in 1490 the Norwegian council of state issued an ordinance making it obligatory on every peasant to lay down a

[1] From *Nature* of June 4.

certain proportion of his land in rye. In Norway the polar limit of summer rye is about 69°, and that of winter rye about 61°; but in Sweden it has been carried along the coast as far north as 65°. The summer rye-crops are generally sown and fit for cutting about the same time as barley, although occasionally in southern Norway less than ninety days are required for their full maturity.

CASSINO'S STANDARD NATURAL HISTORY.

The editors of the 'Standard natural history' have undertaken a most difficult and praiseworthy work. The aim set in the prospectus is to give "a popular account of the whole animal kingdom by the best American authorities," and American forms are to be made especially prominent. Mr. J. S. Kingsley is editor-in-chief, and each type or class is described by some naturalist who has made special investigations in that group. The work is to be completed in six imperial octavo volumes. Of these, two treat of invertebrates, three of vertebrates except man, and the sixth of the human races. Three of them have already been completed.

It is a labor requiring no small study and diligence to collate the immense mass of terribly scattered notes and articles on American zoölogy. But the great danger is, of course, that the work will be too abstruse for popular use, or too popular for scientific accuracy and value. Both these extremes have been uniformly avoided by the different writers with a skill hardly to be expected, and worthy of all praise. There is, too, no such lack of unity or uniformity as one would expect from so large a corps of editors. The figures are remarkably clear and fine. Indeed, the first question that occurs to us is whether some of the luxury in heavy paper, wide margins, and striking full-page cuts, might not well have been dispensed with in order to lower the price of the work, and give it the circulation which it deserves: for to many young students, and teachers in our schools and academies, this work would be the very best help; and yet to them especially the price, six dollars a volume, will be an insuperable obstacle.

The introduction, which occupies seventy pages of the first volume, opens with an account of protoplasm and the cell. In the whole introduction only five pages are devoted to embryonic development. This subject is treated under each group in the systematic portion of the work only in a general and very meagre outline. This is perhaps wise in a popular work, but for that very reason it should have been described in the introduction as fully as is consistent with a purely general outline. Twenty pages are devoted to the nervous system and animal psychology, forming a brief but admirable epitome of what is known of this as yet almost unexplored field. The single page devoted to alternation of generations and parthenogenesis is the least satisfactory in the introduction: the statement is meagre, the line of argument any thing but clear. Evolution is discussed in twelve pages, six of which are devoted to a history of the theory and *résumé* of the contributions of American students. It is certainly one of the most marked defects of the work, that this subject of universal and intense interest should not have been fully presented; all the more, because the age, investigations, and views of the writer fitted him to give us a fair and impartial discussion of the subject.

Of the systematic portion of the first volume, one can but notice the generally high character of the work. It does great credit to its editors. Especial notice should perhaps be given to the interesting discussion of the origin and formation of coral islands. The editor of the chapter on Vermes, the most difficult and least familiar branch, has given too little of the anatomy, and has hardly attempted to show the resemblance and affinities between the different classes. It is certainly a pity that the Brachiopoda, which have so many points of interest, should be dismissed with only three pages. Their enormous abundance in early geologic ages, together with the long battle so hotly waged over their affinities and systematic position, should gain for them more attention, and the more so that this conflict originated through the writings of an American naturalist. Even some of their most important anatomical characteristics are not stated; and of their great geological importance as the predecessors of Mollusca, we have scarcely a hint. But, if the introduction and the description of all the invertebrates except Arthropoda must find place in one volume, we ought, perhaps, to be thankful that some groups are not crowded out altogether. The Tunicata are not described in this volume, and hence will probably appear either before or among the lower invertebrates, — after all, their only proper position at the present stage of investigation. The volume closes with a full and very readable description of Mollusca.

The standard natural history. Edited by J. S. Kingsley. Vol. i. Lower invertebrates; vol. ii. Crustacea and insects; vol. v. Mammals. Boston, *Cassino*, 1884-85. 8°.

The second volume treats of the Arthropoda. The Crustacea, Arachnoidea, and Myriapoda are described by Kingsley, who, however, gives the credit of most of the article on spiders to Emerton's book on that group. Three small orders appear under the Hexapoda, — the Dermatoptera (earwigs), the Pseudoneuroptera, and the Aphaniptera. It is certainly still an open question whether entomologists have not studied differences more than affinities in making orders for the earwigs and the fleas. The lowest orders of insects are described by Packard, the Orthoptera by Riley, the Hemiptera by Uhler, the Coleoptera by Dimmock, the Diptera by Williston, the Aphaniptera by Kingsley, the Lepidoptera by Fernald (moths) and H. Edwards (butterflies), and the Hymenoptera by Howard and Comstock. This volume is almost purely systematic. Here (largely, we may believe, on account of the subdivision of the work and the lack of a complete understanding between the different writers) much important material has been omitted. Either under the general head of Hexapoda or the different orders, a general account of insect anatomy should have been given at length. The whole subject of metamorphosis is treated only in a most bare and meagre outline, and yet there is no topic of which we could rightly expect a more full and careful treatment. Of its necessity or advantage to the type or class, of its probable origin, of the different intermediate grades between the two main types, and of its bearing on the question concerning the ancestral form of insects, we find no notice. Throughout this volume we miss the broad deductions and generalizations which are so interesting and important to the common reader, and which are really the aim and goal of all scientific study.

If, too, the systematic study of insects is deemed the subject of greatest interest to the popular mind, the amateur student would have been greatly aided in determining his collections by tabular classifications of the families and genera. But while the reader will regret some things omitted in this volume, he will not fail to find in each section a description of the most important and interesting forms in each class and order. Each part is a thorough systematic monograph of its class.

The editors of the fifth volume had certain advantages over those of the first and second. The subject was naturally more interesting to the popular mind: it had been much more thoroughly worked by other writers, whose mistakes, at least, they could avoid. They had more space for carrying out their plans. The class possessed a much higher degree of unity, and there were fewer editors. It will not, therefore, seem an invidious comparison if this volume, while perhaps no more accurate than the others, is pronounced the best in the general selection of material, and treatment of the subject. There is a fair amount of anatomy. The relations of the different orders and families are briefly but well noticed. It will be interesting reading for any one, and a valuable reference volume for the working zoölogist. The discussion of the origin and different races of the domesticated animals is in all cases full and good. This volume, of course, cannot treat so purely of American forms as some others, but our American mammals receive their fair share of attention. The systematic arrangement of the different orders, families, and genera, and the general basis of classification, are more sharply emphasized than in any preceding volume.

The point most noticeably worthy of criticism in the volume, and generally throughout the work, is the unnecessary profusion of plates and cuts. If the work were purely anatomical, they would be extremely useful, or even necessary. As it is, they add really only to the attractiveness of the work. The work is really one which all teachers should have, and which every student would find extremely useful; but it is too luxurious for those who need it most. May we not hope that the publisher will some time give us an edition not all too much condensed in the important subject-matter, but with fewer full-page plates, and generally less of the luxury usually so incompatible with the study of the working zoölogist?

MAXIMS OF PUBLIC HEALTH.

THIS book is addressed, not so much to health authorities as to the general reader. Dr. Wight has embodied in it, in a popular style, the results of several years of experience as the health-officer of two large western cities. No attempt is made at a systematic plan; the many subjects pertaining to public hygiene being presented mainly in the form of aphorisms, or detached paragraphs. Legal points with reference to nuisances, contagious diseases, and offensive trades, are introduced; the rights of citizens concerning sanitary matters are clearly and concisely set forth; and important decisions bearing upon them are cited.

Maxims of public health. By O. W. WIGHT, A.M., M.D., health-officer of Detroit. New York, *Appleton*, 1884. 176 p. 12°.

The author's style is entertaining, often witty, and, in his own words, "the intelligent householder who has no time, probably no inclination, for systematic studies, may read herein as he runs, and find hints that will save himself and his loved ones from unspeakable pain and sorrow."

In view of recent results of investigation concerning the comparative value of disinfectants, the author's statement as to the use of vinegar for such purposes, and also as to the value of 'little pinches of sulphur' burned every hour throughout a house in which are patients ill with infectious disease, is misleading. Such a procedure would only prove noxious to the inmates, without accomplishing even the slightest good. It would be far better to wait until convalescence is established, and then vacate the apartments, and proceed with thorough disinfection.

In the words of one of the best authorities on the subject, "There can be no partial disinfection of infectious material. Its infecting power is either destroyed or it is not." The same authority, Dr. Sternberg, also recommends the employment of three pounds of sulphur to every thousand cubic feet of air space, as requisite for thorough disinfection.

The chapters on small-pox, cholera, and other infectious diseases, are valuable, and set forth clearly, and in a salient manner, the importance of preventive measures.

REMSEN'S ORGANIC CHEMISTRY.

In the preparation of this work, Professor Remsen has performed valuable service for the advancement of chemical science in this country, since it will place within the reach of those who are deprived of access to the best sources of information a systematic exposition of the principles of modern organic chemistry. There has long been felt the need of a text-book in English on organic chemistry that would present in a concise form its fundamental principles according to the most recent knowledge of the subject, without entering so far upon details as to render the book too comprehensive for ordinary use. To those who are familiar with the voluminous literature of this subject, the difficulties to be encountered in the preparation of such a text-book are apparent, and they will doubtless appreciate the judicious selection of material and its systematic arrangement in this volume. The thoroughness with which structural relations of organic compounds are treated will be very serviceable to the student, especially the constitution of the aromatic hydrocarbons, including naphthalene and anthracene, and the methods employed in demonstrating the structure of their derivatives.

Certain peculiarities in the nomenclature adopted, and in the form of some of the structural symbols, will probably not find acceptance with all chemists. Yet, concerning the nomenclature of organic chemistry in general, it cannot be denied that usage is far from uniform, and there is even greater confusion in the terms employed than with inorganic compounds. Chemists do not seem inclined to accept fully the rules proposed by the late Dr. Watts, although it must be admitted in their favor that they possess at least the advantages of a system. In the structural symbols of the unsaturated compounds, including the aromatic series, it is difficult to see what is gained by departing from the usual custom of representing fully the valence of the carbon atoms by bonds. There would be little danger of misconception as regards their true significance after the careful explanations given on pp. 213, 225, and 239; and unquestionably a student gains clearer ideas of the chemical changes in passing from one homologous series to another, by writing the structure formulae in full, with the valence of the atoms concerned.

Numerous errors are noticed, few of which, however, interfere with the scientific accuracy of the work. The assertion that citric acid has not been made artificially is hardly in accordance with fact; and it is not strictly accurate to state, that, in the manufacture of acetic acid from wood, the crude distillate is neutralized with soda-ash, since, in this country at least, the acid is usually converted into the calcium salt. In the artificial preparation of alizarine, it is generally understood that this dye-stuff can be made only from anthrachinone-sulphonic acid, anthrachinone-disulphonic acid giving isopurpurine or allied products.

Another important feature of this work is the introduction of occasional experiments designed to familiarize the student with compounds described in the text. This plan could doubtless be extended to excellent advantage; and there would probably be a large demand for another volume of equal size, devoted exclusively to laboratory appointments, manipulation, and experimental work in organic chemistry.

An introduction to the study of the compounds of carbon; or, Organic chemistry. By Ira Remsen. Boston, *Ginn, Heath, & Co.*, 1885. 10+364 p., illustr. 8°.

BACTERIA.

ANY work with the name of Cornil and Babes upon the titlepage demands attention, and this beautiful and complete presentation of the subject of bacteria as related to disease, particularly. In the preface the authors grant that the subject is in so transitory a state that no work of permanent value can be written upon it. Their book, however, approaches as near as may be to such a standard, and is a complete presentation of the condition of bacteriology to-day. They say, with perfect truth, that bacteriology is now a natural science of sufficient importance and completeness to take its proper place in hygiene, etiology, and pathological anatomy, both in the theoretical discussions and practical applications of these branches of medicine.

With the object in view of presenting all the researches upon the bacteria in their proper light, the authors have produced a profusely illustrated book, containing all that is known in regard to these minute organisms at the present time. The contributions to the literature of the subject are so numerous, and of such varying degrees of worth, that a careful selection had to be made. This selection has been unsparing, and, in the main, judicious; so that the whole field of what has been done which is of interest to medical practitioners and hygienists is well placed before us. The work begins with an introduction to the study of the pathogenic bacteria; and a rapid summary of the beginning and progress of discovery in this direction is given. This is of especial value to the student because of the copious references to original monographs that are made.

The development of the microscope for work of this kind, the discussions as to the specific nature of infectious diseases, and the criticisms which bacteriology has undergone, are reviewed, and this is followed by the first part of the book proper. This part is devoted to a consideration of the Schizomycetes in general. The various forms of the organisms are given and illustrated, and their methods of growth are treated at length. Fermentations are defined as they should be, — as "chemical processes undergone by substances broken up under the influence of organisms without chlorophyl, which develop and live in the liquid which ferments."

A full account of all the instruments and materials necessary for work in the observation of bacteria, with the methods of employment, renders this part of the subject plain, while the discussion of the aniline colors conveys information not easy for the student to obtain elsewhere. The methods of culture are given in full; and Koch receives credit for the very great advances he has made in these methods.

The classifications of Cohn, Van Tieghem, and Rabenhorst are spoken of as the latest and best; and a complete list of all the pathogenic bacteria, with their main characteristics, follows.

That bone of contention, 'the attenuation of virus,' finds a place, and the various organisms with which experiments approaching success have been made are allowed to tell their story.

Then the lesions occurring with the presence of pathogenic bacteria occupy the authors' attention; and the modes of entrance, and disturbances of circulation and nutrition produced by them, are all placed before the reader in the plainest way.

A discussion of the 'experimental maladies' of Koch and others closes the first part of the work, which is followed by a complete bibliography of the important works upon bacteria in general.

The second portion of the book is devoted to the special infectious diseases; and a glance at the way in which the work has been done compels the highest praise. Beginning with chicken-cholera (*choléra des poules*), and ending with leprosy, the results of all the investigations upon any disease suspected to be due to a micro-organism are passed upon in the most impartial manner. This includes not only the diseases of man, but also those of animals concerning which any evidence of their bacterial origin has been offered. Space is wanting in which to give in full all the admirable characteristics of this book. The one criticism that might be made is, that it should be divided into two volumes, which would make it easier to handle. There is an atlas of twenty-seven plates, illustrating the various forms of bacteria, which is a valuable work by itself. Armed with the contents of the volume, any one would be competent to discuss the subject of bacteria in any presence; and a glance at the literature referred to in its pages will convince the most sceptical that there must be 'something in it.' We regret that we cannot discuss the contents more at length, but we can assure our readers who are interested in the subject of bacteriology that

Les bactéries, et leur rôle dans l'anatomie et l'histologie pathologiques des maladies infectieuses. Par A.-V. CORNIL et V. BABES. Paris, *Algan*, 1885. 8+696 p., illustr., 27 pl. 8°.

they will find here stated the present condition of all the questions under this head.

NOTES AND NEWS.

The daily papers announce that the U.S. commissioner of agriculture has established as a part of Dr. Riley's division a branch of investigation relating to economic ornithology, and has appointed Dr. C. Hart Merriam, a well-known ornithologist, and secretary of the American ornithologists' union, a special agent to take charge of this part of the work. Dr. Merriam will make his headquarters at Sing Sing, N.Y., until Oct. 1, and after that at Washington. The scope of the investigation will cover the entire field of inter-relation of birds and agriculture, particularly from the entomologist's stand-point. The inquiry will relate primarily to the food and habits of birds, but will include also the collection of data bearing on the migration and geographical distribution of North-American species. In this last inquiry the department hopes to have the co-operation of the ornithologists' union, Dr. Merriam being at the head of the union's committee on migration.

— The sixth annual meeting of the Society for the promotion of agricultural science will be held at Ann Arbor on Tuesday, Aug. 25. There will be public sessions in the forenoon and afternoon, and a business meeting in the evening. The entomological and botanical clubs of the association will also hold their meetings on Tuesday.

— The Western society for psychical research was organized at Chicago in May, and held its first meeting on Tuesday evening, June 3, at the Sherman house in that city. The president, Dr. A. Reeves Jackson, delivered an address, which has been published. Committees were appointed on thought-transference; hypnotism, clairvoyance, and somnambulance; apparitions and haunted houses; physical phenomena; and psychopathy, "under which head attention may be given to what is popularly known under the various names of 'mind-cure,' 'faith-cure,' 'metaphysical treatment,' 'magnetic healing,' etc." The officers of the society are, president, Dr. A. Reeves Jackson; vice-presidents, Rev. C. G. Trusdell and Professor Rodney Welch; secretary and treasurer, J. E. Woodhead.

— The section of mechanical science (and engineering) of the American association for the advancement of science promises to have interesting sessions at the Ann-Arbor meeting. The committee on the best method of teaching mechanical engineering — Prof. J. Burkitt Webb, Prof. George J. Alden, Dr. Calvin M. Woodward, and Professor Arthur Beardsley — request all who are interested to make sure of being present at the particular session to be devoted to this subject, and to come prepared to take an active part in the discussion of the same. The committee on the use and value of accurate standards, screws, surfaces, and gauges, and of systematic drawings in the modern machine-shop, — Prof. William A. Rogers, Mr. Oberlin Smith, and Prof. J. Burkitt Webb, — have arranged for a special session upon this subject; and they would urge those who feel its importance to present papers, and join in the discussion.

— In his annual address as president of the Royal geographical society, Lord Aberdare called particular attention to a report (which is soon to be printed), by Mr. Scott Keltie, on the state of geographical education in Great Britain. According to this, it appears that the books are poor, the instruction inadequate, and the encouragement wanting in almost all schools, and particularly in schools of high grade. Geography as a class subject is not recognized by professorship or readership in the universities. On the continent, and especially in Germany, the case is very different. Twelve professorships of geography may be found in the twenty-one universities of Germany, and most of the twelve have been founded within the last twelve years. The ideal aimed at is a continuous course of geographical instruction from the youngest school-year up to the university. Mr. Keltie gives examples of some of the lessons which he heard, indicative of a masterly as well as a practical treatment of the subjects in hand. Lord Aberdare commended heartily this new effort of the geographical society to secure better geographical education. Toward the close of his address, he referred to the past year as full of geographical researches. "Never has the ferment among nations been so wide-spread, or prophetic of such great consequences," he remarked with reference to the operations of the French in Asia and Africa; the Russians in central Asia; the English in Afghan, on more than one border of India, on all sides of Africa, and in Oceanica; the Germans on the African coasts; and the Italians on the Red Sea. These invading hosts, he continues, have had in their trains "naturalists, ethnologists, geologists, — men trained in all the sciences which illustrate geography; . . . knowledge and conquest thus march hand in hand; . . . out of the nettle danger, we pluck the flower knowledge; . . . however much we deplore the violence, we cannot be blind to the scientific results which followed upon the displacement of barbarous people by the civilized."

— It is suggested by the chairman of Section I of the American association for the advancement of science, that a subject, perhaps of principal investigation and discussion at the ensuing meeting, shall be, "The daily ration of the food of working-people in the different sections of the country. 1°. Of what does this ration now consist, and what does it cost? 2°. What proportion does the average cost of food bear to the total cost of living? 3°. What is a true or standard ration, measured by the relative proportions of proteine, fats, and carbohydrates? 4°. What are the kinds of food which contain proteine in largest proportion at the lowest relative cost? 5°. In what manner can a variety of daily rations be made up, each of which shall contain the requisite quantities of nutriment? 6°. Can a schedule of rations at low cost be presented, whereby much of the present waste of

f money expended in its purchase, may be °. In what way can information be distrib- this subject, so as to enable working-people e economy in the purchase and in the prep- food?" The attention of the chairman, tkinson, has been lately called to the great the statistics of consumption; and he has ised the valuable aid of the chiefs of the reaus of statistics of labor, and of Prof. water of Middletown, Conn., in making n for this discussion.

Robert H. Thurston of Stevens institute, N.J., has accepted the post of professor ical engineering, and director of Sibley col- rnell university, Ithaca, N.Y.

xpedition under the auspices of the Royal al society of Vienna was to start in June ar for the region of the Kongo. Its primary o explore the territory lying on the water- een the Kongo and the Nile, with a view ing the exact geographical knowledge of n, and also to studying its natural history logy, and investigating the commercial re- the new Kongo state. A secondary object obtain news of a former party of explorers, been for two years kept confined in the the upper Nile on account of the Mahdi n account of the same revolt, the present be obliged, instead of taking the usual Nile o to the mouth of the Kongo, and work up to the region of the intended explorations. ley Pool two steamers belonging to English up the river; and the leader of the expe- Oscar Lenz, hopes to be able to use one of ach a suitable point on the upper Kongo rting-point of his explorations. From this Dr. Lenz has formed no definite plans, but d according to the necessities of the occa- ring that the territory is as yet completely l, and that every step will add to our geo- knowledge. He hopes to return in about a half; and, indeed, the sum of twenty-five florins, which has been raised for the ex- vill cover the expenses for no longer time

French Academy of sciences has awarded ute's biennial prize of twenty thousand Dr. Brown Séquard.

Japanese have at last, says *Nature*, after itation, promulgated a patent law. As in with respect to copyright, it was argued, no patent protection, the Japanese got the the inventions of the whole world. The ppears, like many other recent Japanese compiled from similar laws of other coun- clause from England here, from France n Germany in another place, as seemed ad- he circumstances. The term of protection ears. "Articles that tend to disturb social y, or demoralize customs and fashions, or us to health," and medicines, cannot be The inventions must have been publicly applied within two years; and patents will become void when the patented inventions have been imported from abroad, and sold, — an illiberal provision, which prevents the patenting of foreign inventions in Japan, unless the inventor also manufactures them in the country, and which therefore renders the new law practically useless to any but the Japanese inventor. The fees are low, amounting to about three pounds sterling for fifteen years' protection, the one payment down being sufficient; while there are no annuities or annual payments for keeping the protection in force, as in many European countries. The punishments for breaches of the regulations are sufficiently severe to act as a warning against infringement.

— The organizing committee of section A of the British association has arranged for the following discussions at the Aberdeen meeting: 1°, On kinetic theories of gases; and, 2°, On the standards of white light.

— Professor Loomis's twenty-first 'Contribution to meteorology' (*Amer. journ. science*, July) returns to the discussion of the direction and velocity of movement of low-pressure areas, — cyclones, — which had already been treated in several earlier papers. The numerical results now attained agree closely with those already published. The average progressive velocity of cyclonic storms is given as follows: Bay of Bengal and China Sea, 8.4 miles per hour; West Indies, 13.7; Europe, 16.7; middle latitudes of Atlantic Ocean, 18.0; United States, 28.4. When this is combined with the results given in Finley's paper on storm-tracks, we find that our lake region possesses the unhappy pre-eminence of being visited by the most numerous and fastest-moving storms in the world, as far as the world is now known. Taking further account of the strong contrasts of winter temperatures between the Gulf of Mexico and the Hudson-Bay region, which supply the winds in the front and in the rear of the storms, we find sufficient explanation of the frequent and violent changes of weather in our interior states. Professor Loomis examines also the degree of correspondence between the average course of storms and the mean direction of the wind. While the two are not coincident, they are evidently connected, and, as the author points out, the departures of one from the other are probably due to the control exerted on storm-tracks by rainfall, as well as to the fact that the mean direction of the wind is derived from truly superficial observations, while the course of the storm marks the path of a commotion that affects a considerable thickness of atmosphere. It is found that for the mid-Atlantic, near latitude 50° north, the average storm-path corresponds very closely with the average wind direction; but in the western part of the Atlantic the storms turn 30° to the north or left of the wind, while in the eastern part the deviation is changed to 30° to the south or right of the wind. This may find explanation in the effect that the sea between the continents has on the direction of the winds near the shores. The ratio between the mean progress of storms and mean velocity of the

winds for the United States is 28.4 : 9.5, and for the North Atlantic it is 18.0 : 29.8; and this evidently depends largely on the control that land friction exerts on wind velocity.

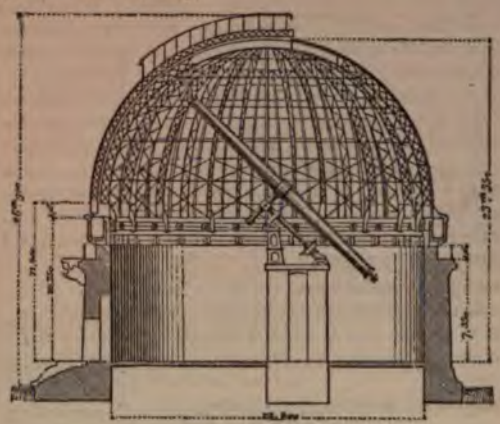


Fig. 1. — Section of floating dome at Nice.

— We learn from *Nature* that the floating dome presented by Bischoffsheim to the observatory at Nice is now finished, and has been recently on exhibition in Paris. It is intended to cover a colossal telescope. It is twenty-two metres in diameter inside, and has a circumference of more than sixty metres, or two metres more than the dome of the Pantheon. Instead of rendering it movable by placing it on rollers, according to the ordinary method, it is closed below by a reservoir for air, which rests on the water in a circular basin (fig. 2). A set of rollers is also placed under the dome to prevent oscillation, and for use when repairs are needed. This system of suspension is said to be so perfect, that, in spite of its great weight, a single person can turn it completely round the horizon. To provide against the water freezing, it has been proposed to dissolve in it a salt to the point of saturation, but it is feared that this may cause corrosion of the apparatus. Frosts, however, are rare in Nice, and special experiments on this subject will be made.

— 'The germ-theory of disease' formed the subject of the 'Alumni lectures' given this year by Dr. W. H. Thomson before the graduates of the Albany medical college.

— We learn from *Nature* that Mr. Burbidge, of the Trinity-college botanical gardens, Dublin, points out that Edelweiss is easily grown in English gardens from seed. It is sown in common garden-earth in a cold-frame, and, when large enough, each little plant is placed in a small pot in a mixture of loamy earth and old lime rubbish; or the plants, Mr. Burbidge says, are equally well pleased by a niche in a sunny rock-garden, provided a supply of their favorite lime rubbish or old mortar be afforded them.

— At the meeting of the Board of visitors of the Royal observatory, Greenwich, the annual report of the astronomer royal was received. In this it is mentioned, that on the publication of Professor Pickering's 'Harvard photometry,' all stars which he had noted as brighter than the sixth magnitude, and which had not been recently observed at Greenwich, were inserted in the working-catalogue, in order that the next Greenwich catalogue might contain all stars, down to the sixth magnitude, which have not been observed at Greenwich since 1860. It is also stated, that, as announced in the *Times* of Jan. 1, the public clock at the observatory entrance, and the other mean solar clocks, were put forward twelve hours so as to show Greenwich civil time, starting at midnight, and reckoning from 0 h. to 24 h., which would correspond with the universal time recommended by the Washington conference. The change from astronomical to civil reckoning has also been made in all the internal work of the observatory, and has been carried out without any difficulty. Greenwich civil time is found to be more convenient, on the whole, for the purposes of this observatory; but its introduction into the printed astronomical observations has been deferred to allow time for a general agreement among astronomers to be arrived at. It is proposed, however, to adopt the civil day without further delay in the printed magnetical results, thus reverting to the practice previous to 1848, and making the time-reckoning harmonize with that used in the meteorological

Fig. 2. — Section of float for astronomical dome at Nice.

results, the reckoning from 0 h. to 24 h. being for the future adopted in both cases. This was probably the first step taken after the Washington conference in conformity with its recommendations.

SCIENCE.

FRIDAY, JULY 31, 1885.

MMENT AND CRITICISM.

CIRCULAR signed by Elliott B. Page, neral secretary for America, it seems American board of control of the cal society held a session at Cin- July 4, and, presumably among ness, passed a resolution to the effect Theosophical society shall assume ise supervision of the American psychical research." This board thereupon 'authorized and required' number, Professor Elliott Coues, the n ghost-smeller, "to act as censor l American society for psychical re- d to publicly review and criticise ll of the proceedings, transactions, or other printed matter which the y may publish, at his judgment and " The board further "expressly m, when any fact in psychic science been satisfactorily established by can society for psychical research, such fact to the said [American] ording to the doctrines, and upon les of psychic science, of which the al society is the custodian in the tes."

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r of sifting the evidence in regard l phenomena is no mean one; and e that the managers of the Ameri- y for psychical research will feel bted that one so well posted in the of the occult world should have nted to the duty of aiding them, t their errors when they may have y, and informing them when they a discovery. To be sure, on ac- ur kindly feeling toward Professor declined last winter to publish some ements in regard to ghosts which

he had seen, felt, heard, and smelled, but which were afterward published by our less thoughtful contemporary, *The nation*. Possibly the members of the Theosophical society may have seen more ghosts than have been favored to our vision, and, considering themselves well posted, have felt justified and called upon to put forward Professor Coues as a public censor. Now, what body will come forward to 'assume and exercise' supervision of the American board of control of the Theosophical society?

ALTHOUGH THE CONFLICT over the evolution of man is practically ended so far as the general question in the opinion of scientific biologists is concerned, yet the special question through what series of forms man has been evolved is still unsettled. In regard to the descent not only of the vertebrates and the various classes of vertebrates, but also of the various orders of mammals, our knowledge has been rapidly extended, and we can now outline with some degree of accuracy the genealogical history of the higher animals. Of some forms we can give with remarkable precision the exact ancestry for some distance, but man is not one of these forms. The origin of a species may be ascertained either by direct observation or by inference: the former is the method of paleontology; the latter, of embryology and morphology. Since the paleontologist has as yet gathered no material to trace the immediate ancestry of man, we are obliged to trust to the indications of the embryologist, who finds in the foetal structures hints of ancestral organization, which, properly utilized, guide investigation to sure results. A most interesting step in advance is the discovery by Professor Fol, noted in another column, that the human embryo has four temporary caudal vertebrae, which must be interpreted as proof that man is derived from a long-tailed animal. Evidence is thus accumulating that the human

species is indeed related to the monkeys, possibly more closely than even to the anthropoid apes.

The report on the museums of America and Canada, recently made by Mr. Ball of the Dublin museum to the Science and art department of England, is not a very satisfactory document. Apparently designed to furnish hints to similar museums in the United Kingdom, it is nevertheless chiefly occupied with descriptions of the scope of the different establishments and of the contents, and to some extent the general arrangements of the several museums. But the account of the last is generally unsatisfactory and imperfect, while very slight or no mention is made of such devices as are characteristically American, and in which museology has been notably advanced by us. The best applications of American ingenuity to questions of installation are unnoticed: such as, the methods by which cases are made air-tight, and are locked at several points by a single turn of the key; by which shelf-supports are made light, secure, and graceful, and variable at pleasure with slight labor; by which a case applied to one use can be converted in a few minutes to another very different one without interfering with its sightliness;—these and many other problems of museum economy are altogether overlooked. The unit system of the National museum and the systematic registry of the Smithsonian institution are praised but not explained; while the applications of museums to public educational uses by the special arrangement of their material is very inadequately treated. Although it is true that in this last point our museums have more to show in promise than in fulfilment, we have still not a little to teach Europe; while America, on its side, has much to learn from such collections, for example, as the Liverpool free museum.

LETTERS TO THE EDITOR.

Miocene deposits in Florida.

In view of the discussion as to the extent of miocene deposits in Florida, it may be of interest to call attention to the discovery of the extremely characteristic Ecphora quadricostata by Dr. R. E. C. Stearns at Tampa. The matrix is a compacted fine greenish sand, crumbling under moderate pressure. The locality of the find is on the long rocky point. It is probable that there is a large area in Florida corresponding in age to what has been called miocene in Virginia and the Carolinas, and that it includes part of the phosphatic sandstones, as well as the mammalian and reptilian bone-deposits noted by Jeffries Wyman, Leidy, Neill, and others.

Wm. H. Dall, *U.S. geol. survey.*

Washington, D.C., July 23.

Abert's squirrel.

I have read with interest the article in *Science* respecting the Sciurus Aberti, from Dr. Shufeldt.

Sciurus Aberti is not uncommon in northern Colorado. I have seen it as far north as the Cache à La Poudre River, about 40° 30′ north latitude, and up to eleven thousand six hundred feet altitude near Gray's Peak. In this part of Colorado (latitude 39° 45′ north), and along the South Platte River in the mountains south-west of Golden, I have seen this spring three different individuals,—two of them black; one gray and lighter beneath, with tips of its hair on its back and sides mottled with black. In fact, we see them here from gray to blackish gray, and entirely black, although but little differing in size, and all noticeable by long, tufted ears. It is more terrestrial than arboreal in its habits, and, from its extreme range, cannot be called or considered a southern species straggling northward. Having been in the San Francisco mountains, and in all northern Arizona, I have not seen any S. Aberti as deep black as those in northern Colorado.

I have mentioned its existence here up to eleven thousand six hundred feet altitude; but I should qualify this statement by saying, that a squirrel in every respect identical with the S. Aberti was seen by me several times at the Loneland Pass, west of Gray's Peak. But it was more than twice its size; indeed, larger than any other species of gray, black, or fox squirrel I have ever shot or seen. Its habitat was near timber-line, feeding on pine-cones, and generally returning to the enormous heaps of disintegrated rocks which seemed its usual abiding-place. I never succeeded in getting a specimen of this rare squirrel at that place.

E. L. Berthoud.

Golden, Col., July 2.

Color associations with the months.

A lady whom I had the pleasure of visiting to inform myself concerning some curious planchette-writing in which she had participated, has, she told me in answer to my inquiries, several interesting arbitrary associations of the class which was discovered by Mr. Francis Galton, and of which the number-form is the most familiar example. She had a curious number-form,—a form for the twenty-four hours, and another for the months. A sister had likewise various forms, but different from those of the first-mentioned lady. Both said that music always speaks. 'Why, yes! it speaks, *of course*,' they both remarked.

The one to whom I wish specially to refer associated colors with the months, and in a way which struck me as particularly curious, as it is a jumble of arbitrary and of obviously natural associations.

January, February, and March are bright yellow; upon a second question, 'shining white yellow.'

April is blue, 'the shade ladies call French blue.'

May, light yellow, 'not at all like January.'

June, bright green.

July is glaring yellow; and *August*, orange.

September is golden brown; *October*, dark brown.

November is 'indiscriminate gray. I cannot exactly describe it: it is like lead color.'

December is gray.

This case appears to me sufficiently different from any of those mentioned by Galton to deserve special notice.

It would be very desirable, I think, to make a systematic investigation of the influence of heredity on such associations of color and form. Could not the Psychical society undertake such work?

CHARLES S. MINOT.

Boston, July 22.

Maxwell's demons.

Sir William Thomson has shown that since work is readily converted into heat, while heat is never wholly transformed into work, or in fact into any other form of energy, there must continually take place what Tait calls a *degradation* of energy; while its *dissipation* is pronounced to be the inevitable consequence of certain laws, connecting heat and work, established by thermodynamics.

Maxwell has pointed out that one of these laws is by no means a necessary truth ['Theory of heat,' chapter xxii., Limitation of the second law of thermodynamics]. Theory shows, that, in what is called a state of uniform temperature, some of the molecules of a body have by chance much greater velocities than others. If, therefore, as Maxwell says, we could suppose the existence of small beings, capable of following the motion of each molecule, and opening or shutting holes in a partition so as to allow the fastest molecules to pass through one way and the slowest the other, it might be possible theoretically, without expending any work, to separate a gas into two portions, — one hot and the other cold, — in contradiction to the second law of thermodynamics.

It seemed to me of interest to point out that what, as Maxwell has shown, could be done by the agency of these imaginary beings, can be and often is actually accomplished by the aid of a sort of natural selection.

When the motion of a molecule in the surface of a body happens to exceed a certain limit, it may be thrown off completely from that surface, as in ordinary evaporation. Hence in the case of astronomical bodies, particularly masses of gas, the molecules of greatest velocity may gradually be separated from the remainder as effectually as by the operation of Maxwell's small beings.

It is true, that, in overcoming the attraction of the central mass, the escaping molecules may be deprived of the whole or a portion of their velocity; but the transformation of heat into work marks the process still more distinctly as an exception to the second law of thermodynamics, which "asserts," according to Maxwell, "that it is impossible to transform any part of the heat of a body into mechanical work, except by allowing heat to pass from that body into another at a lower temperature" ['Theory of heat,' chapter viii.].

One might now dismiss the subject as a mere curiosity; but is it not possible that what may be called the *renovation* of energy plays an important part in the history of the universe? While philosophers, anxious to preserve their store of available energy, may speculate on the possible equivalence of renovation and dissipation, will not the scientist hesitate, without further examination, to extend the principle of universal dissipation from physical to astronomical phenomena?

HAROLD WHITING.

The classification and paleontology of the U. S. tertiary deposits.

In penning my protest (*Science*, June 12) against some recent geological and paleontological speculations of Dr. Otto Meyer, I had intended that it should represent my final words in the matter, inasmuch as the article under discussion appeared to me unworthy of exhaustive criticism. The appearance of instalment No. 2 of the same series (which, if any thing, is only more remarkable than No. 1), and a rejoinder to the first from Prof. E. W. Hilgard, constrain me to add a few additional paragraphs, more, perhaps, of a general than of a special character.

Professor Hilgard says, "I emphatically agree with Heilprin as to the impossibility of subverting the cumulative stratigraphical evidence to the effect that the relative superposition of the several principal stages — the Burstone, Claiborne, Jackson, and Vicksburg groups — cannot be otherwise than as heretofore ascertained;" and, further, "I recall to my mind that years ago I had occasion to repel a similar attempt, on the part of Mr. Conrad, to subvert the relative position of the Jackson and Vicksburg groups upon supposed paleontological evidence." It might appear, from the conjunction of these expressions, that the only evidence supporting the accepted superposition of the different members of the southern old tertiaries was of a stratigraphical character, and that the paleontological evidence was in conflict with that derived from stratigraphy. As a matter of fact, however, the paleontological evidence, whatever it may have been when Conrad first devised his scheme of classification, is, as we now know it, absolutely confirmatory of the pregnant facts which the stratigraphy of the region presents; and, indeed, it would be difficult to find a region of similar deposits where it is more so. The absence or scarcity of forms of a distinctively old-type facies in the Vicksburg beds, and the introduction there of new forms whose equivalents or immediate representatives are known only from the newer horizon, are sufficient in themselves to establish the position. While it may be true, although this is far from being proven, that not a single one of the Vicksburg fossils is identical with species belonging to the typical oligocene basin of Germany, it is equally true that several of the species find their analogues or equivalents in the deposits of San Domingo, which are indisputably of post-eocene age; and whatever Dr. Meyer's own individual opinion may be as to the bugbear Orbitoides, and to its value as a 'leitfossil,' the keen appreciation of Hautken, Rupert Jones, Karrer, Fuchs, Suess, and Duncan has long since settled the question. It is amusing to have the forty-year old opinions of D'Orbigny and Edward Forbes referred to as authority on the value or no-value of certain fossil forms whose organization was barely known at the time that the opinions were rendered, and whose differences from other (distantly) allied forms were not even dreamed of. With singular perversity of purpose, Dr. Meyer fails to inform his readers that the American foraminifer whose merits are discussed by Professor Forbes, is confounded by that naturalist with a form which belongs not only to a distinct genus and family from Orbitoides, but to a distinct sub-order.

Aside from the testimony of the Vicksburg fossils

themselves, however, the dominating faunal features of the intermediate Jacksonian ought to have carried conviction, or nearly that, to the mind of any unprejudiced paleontologist. The Zeuglodontidae, represented (as generally considered) by the two genera Zeuglodon and Squalodon, are thus far positively known (in their earliest forms) only from late eocene or miocene (and oligocene?) deposits; and the only species of the former other than the American forms, and those obtained by Schweinfurth from Birket-el-Keroun (and recently referred by Dames to the eocene or oligocene horizon), is a member of the same group of deposits (the Bartonian) which in England correspond in position with the Jackson beds; i.e., overlie the Parisian (equal Claibornian). In that which relates to the oligocene (Orbitoide, Nummulite) rock of the peninsula of Florida, whose existence appears to give Dr. Meyer a considerable amount of anxiety, and which would better suit the requirements of the new theory were it cretaceous, our author need entertain no doubts: the rock is there, and has recently been found in several other localities which were not known at the time the mapping for my book was executed. No amount of chastising of Orbitoides will efface the testimony which it has unguardedly left behind.

I fully agree with Professor Hilgard as to the value of tracing derivative relationships between the species of the different formations, — a field of inquiry which I entered some years ago, but from which I have thus far drawn but barren fruit. In such inquiry it is necessary, however, to know the relative positions of the different deposits with which one is dealing, and not to proceed, as Dr. Meyer has done, from top to bottom, believing that top was bottom, and bottom top. Some curious evolutionary results might arise from this novel method of procedure.

For the rest, I need only reiterate my warning to geologists and paleontologists against the acceptance of the vagaries which are set forth in the two articles before us. Having given attentive study to the fossils from the region in question for a period extending over six years, and with the types of by far the greater number of species that have ever been described from the formation under my eyes and under my charge, I can say that those portions of Dr. Meyer's papers which relates to systematic paleontology are of about equal value with the geological, and clearly show that the author has not yet even found time to identify the numerous species which he is discussing. Pseudo-science of the kind to which we are here treated should be exposed. ANGELO HEILPRIN.

Academy of natural sciences, Philadelphia, July 20.

The etymology of 'ginkgo.'

Mr. Lester F. Ward, in a note to his paper on the ginkgo-tree (*Science*, v. 495, June 19, 1885), says, "The orthography of this word ['ginkgo'] is not settled. Linné wrote 'ginkgo,' as did also, apparently, Kaempfer before him ('Amoenitat. exotic.,' 1712), and as all botanists since have done, and do still; but nearly all lexicographers reverse the consonants, and write 'gingko.' . . . In the supplement to Webster's dictionary the word is said to signify 'silver fruit;' and it would seem that the etymology ought to determine the orthography."

The first use of the word *ginkgo* occurs in Kaempfer's 'Amoenitates exoticae,' p. 811, where he says, "杏銀 *Ginkgo*, vel *gin an*, vulgo *itsjò*. Arbor nucifera folio adiantino." And then he adds a page of detailed description, and a page of figures of the leaves and fruit. He gives the two Chinese characters that are still used for the fruit in Japan: they are pronounced by two different methods, according to two provincial pronunciations brought to Japan long ago, and corrupted there, — either *ginkiyoo* (not the common English *oo*, but each *o* long, or as in 'oolite;' and the *g* as in 'give,' of course), or, much more commonly, *ginnan;* and they mean 'silver apricot,' or 'silver almond.'

It is plain that Kaempfer's *ginkgo* was a misprint for *ginkjoo;* since the second character (杏) is also given by him on p. 798 for the apricot, and transliterated *kjoo*, — a very reasonable way to write it, with the German sound of *j*, and the long *o* doubled, as actually pronounced. Undoubtedly, the last syllable of the word was written in the same way at p. 811; but, in printing, it became *kgo*, and the error has been sacredly perpetuated until the present time.

The word *ginnan* (the first *n* is doubled in pronunciation) is likewise misprinted, on p. 812, 'ginnaò.'

Instead of *ginkiyoo*, or *ginnan*, the name of the fruit, the tree is called in Japan *ichoo* (two long *o*'s, as before, not the English *oo*, but the *ch* as in English), and that is what Kaempfer writes *itsjò*.

Thunberg ('Flora japonica,' 1784, p. 358), probably guided by his own ear, in amendment of Kaempfer, writes the name *ginko*, which represents a third less common Japanese pronunciation of the second syllable, *koo*, with two long *o*'s; and he speaks of the great size of the tree, comparing the thickness of the trunk to oaks. Possibly the evident errors of the Linnean name in spelling, pronunciation, and meaning (signifying the fruit rather than the tree, though Dr. Williams's dictionary says the same name is in China given also to the tree; and it is in Japan, too, sometimes given to the fruit-bearing sex of it), may be considered strong arguments in favor of the name 'Salisburia;' or, perhaps better, in favor of Thunberg's reform of the orthography — if that be not treading on altogether too holy ground.

Kaempfer pointed out the resemblance of the leaf to Adiantum, not only on p. 811, but again in the detailed description on the next page.

My copy of Kaempfer has an old manuscript note, as follows, — "1753. See this plant in Mr. James Gordon's garden at Mile End, London," — showing that the tree was very early introduced in Europe.

The tree sometimes grows to a very large size, and there was one about five feet in diameter in my garden at Yedo, on high ground; but damp soil is said to be its preference. The juice of the thick pulp outside the nut is very astringent, and is used in making a somewhat waterproof, tough paper, and a preservative black wash for fences and buildings. The meat of the nut is cooked and eaten.

BENJ. SMITH LYMAN.

Northampton, Mass.

THE RECENT LAND-SLIDE IN THE WHITE MOUNTAINS.

BETWEEN Jefferson and the well-known Fabyan House, in the White Mountains of New Hampshire, is an oblong elevation of thirty-six hundred feet above the sea, known as Cherry Mountain. It is about seven miles in length

and three miles in width, the longer axis being north and south, and it rises from a nearly level area elevated fourteen hundred feet above the sea. On the east side, there is a close connection with Mount Deception, a spur from the principal White-Mountain range; and the Cherry-Mountain road, passing over the lowest point, reaches the altitude of twenty-two hundred feet. At the very north end of Cherry Mountain is an elevation known as 'Owl's Head,' about seventeen hundred and fifty feet above the plain. Down the steep side of this part of the mountain, at six A.M. of Friday, July 10, there rushed an immense mass of earth, rocks, and trees, producing a land-slide destined to be as memorable in the annals of White-Mountain history as the famous Willey slide of 1826. In less than five minutes this mass of earth slid down an inclined plane one and a half miles in length, a vertical descent of seventeen hundred feet, completely demolishing a partially built house, a large barn, injuring fatally one man, killing several cattle and smaller domestic animals, both those confined within enclosures and those feeding in the open field.

At the very base of the mountain is a carriage-road running east and west. Upon the south side, upon a slight eminence, stood Mr. Oscar Stanley's house, with a small orchard partly behind, and partly to the west. The stream which descended the valley of the slide flowed very near this house, ordinarily discharging as much water as would pass through a hoop of twelve inches diameter. A quarter of a mile nearer the mountain stands a small house occupied by John Boudreau. The *débris* nearly touched Boudreau's doorsteps, but had not force enough to remove Stanley's orchard. It spread over seventy-five feet width of grass-land, while the principal portion passed on against the house. The greater elevation of the orchard seems to have insured its preservation.

Mr. Stanley, with two joiners, were at work in the house at the time of the slide. For half an hour previous there had been a heavy thunder-shower, but it was only raining gently when there came a noise sounding something like thunder. Stanley spoke to his companions, who suggested the noise came from a train on the railway. He ran to the door, saw the slide coming, and cried out, "I am going to get out of this: the mountain is coming down!" They all jumped for their lives, and barely escaped. The hired man, Walker, who was milking in the barn, was less fortunate. He heard the noise, ran from the barn, but was caught by the flying timbers and badly bruised, so that he died a few days later. He was buried on the 16th, upon the anniversary of his birth, and also the day set for his marriage with the oldest daughter of Mrs. Stanley.

The arable land of Mr. Stanley, amounting to about twenty acres, lay upon the north side of the road, and it is entirely covered by mud and stones. Grass, oats, wheat, potatoes, and the garden were all buried under several feet thickness of 'calamity,' as he described it. Several observers from a distance heard the noise, and saw the mass slide down the mountain. It would seem that rain had fallen copiously during the whole of the night previous, completely saturating the natural earth or decomposed granite gravel of the mountain-side. Just before six A.M., another thunder-cloud moved against that which had been discharging during the night, so that the slide seems to have been nearly synchronous with the collision of the clouds. This shock would naturally produce what is commonly called a 'cloud-burst,' when an extraordinary amount of water falls. This, meeting *débris* already saturated, produced the conditions favorable for the descent of the mass, especially should any accidental cause furnish a starting-point. Such a cause existed in this case, which will be mentioned presently.

The rock at the summit is peculiar, being a syenite characterized by very small crystals of hornblende. Two hundred feet down, this is replaced by a greenish porphyry, verging into a granite called the 'Albany granite' in the 'New-Hampshire geological report.' This porphyry is not very thick. Below it is found the rock making up the principal bulk of Cherry Mountain, a species of protogene or chloritic granite. All these rocks are traversed by jointed planes, dividing the granites into parallel plates two, four, or more inches thick, and all dipping northerly, or down the steep slope at an angle of about 20°.

This slide started less than forty feet below the summit of Owl's Head, from a precipice of perhaps ten feet altitude. The site is further designated by a vacant place in the precipice, from which large blocks were detached, presumably the beginning of the catastrophe. For a hundred and eighty feet vertical descent, the slope may be 20°, and the direction of the movement N. 60° E. for about half a mile. Then follows a sort of shelf, or step, where the inclination suddenly increases, becoming perhaps 30° to 35° for a short half-mile in distance, and a fall of six hundred and fifty feet.

THE RECENT LAND-SLIDE ON OWL'S HEAD.[1]

The path of the slide, commencing at a single point, gradually increases in width till the maximum of a hundred and seventy-five feet is reached in a vertical descent of three hundred feet. Essentially this width is maintained for a vertical descent of six hundred and fifty feet, when there is a change in the direction on its reaching the bed of the stream, and the width is narrowed as much as thirty or forty feet. Very many smooth ledges were uncovered in the first five hundred (vertical) feet from the starting-point, and the angle of the slope has lessened to about 20° at three hundred feet from the top to the bend six hundred and fifty feet below the starting-point. This part of the slide may be seen to excellent advantage from the village of Jefferson Hill, and other elevated points in the neighborhood. The lower part of the slide is obscured from most points by the adjacent forest.

[1] The illustration of the slide is from a photograph by D. W. Butterfield, photographer of the Boston and Lowell railroad.

Coincident with the change in the direction from N. 60° E. to nearly north is a diminution in the slope and a deepening of the excavation. At first not more than a foot or yard in depth seems to have been removed. At the bend the depth of the middle portion of the excavation is as much as forty feet. The distance from the bend to the extreme end of the slide is about one mile. The slope falls from 20° to about three hundred feet to the mile below Stanley's house. The width of this lower section is usually about a hundred and fifty feet, being ninety-five feet at the narrowest place below Boudreau's house, and a hundred and seventy-five feet just above Stanley's. So rapid was the descent, that every change in the direction, caused by bendings of the cañon, carried the *débris* much higher upon the bank in front. There is a marked absence of large blocks of stone above Boudreau's. Near his house a rather large bowlder was stranded. Others appear just

above Stanley's and in the field below. Those near Stanley's, perhaps six feet long, seem to have come from the precipice at the top of the mountain, as identified by the mineral composition. The largest block examined in the field is twelve feet long, six feet wide, and five feet high, and is of porphyry. Others were not examined, but these suggest that the syenite fragments started from the summit precipice. These struck the projecting ledges of porphyry three hundred feet lower down at the commencement of the steeper slope, when all of them combined furnished the accidental force which urged the moistened *débris* down the mountain-side with such fearful velocity.

The *débris* is thoroughly mixed with vegetable loam, and the black soil of the forest; so that, though covered by a yard thickness of mud, the field may again become productive to tillage. This mud disported itself very much like lava flowing down inclined slopes, the terminations being escalloped, and the surface waved by small ridges like ropy lava.

Briefly, then, the conditions giving rise to this slide upon Cherry Mountain seem to have been the presence of gravelly granitic *débris* upon smooth ledges having a jointed structure pointing downwards. This *débris*, thoroughly saturated by water, became plastic and moved downwards just as soon as the blocks of syenite and porphyry started on their course, breaking off trees, and thus increasing the moving mass every rod of the way, till the lessened slope caused the viscous flood to stop. Such has been the history, probably, of all the more notable slides in the White Mountains.

The locality may be reached most conveniently by way of the Whitefield and Jefferson railroad. All trains will stop at the 'slide station' if desired. This is a point only seventy-five rods distant from the base of the slide.

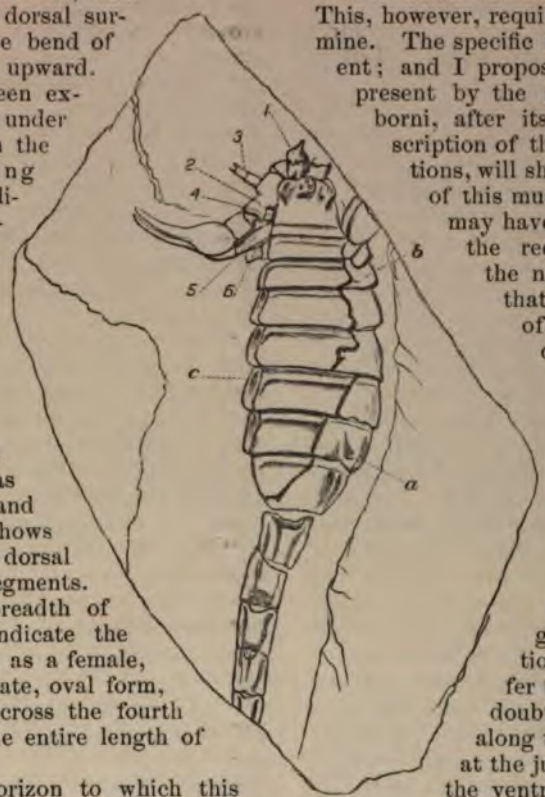
C. H. HITCHCOCK.

AN AMERICAN SILURIAN SCORPION.

ON Nov. 12, 1884, the announcement that a fossil scorpion had been found in Silurian rocks in Sweden was made to the Swedish academy of sciences, and the printed notice of it published in the *Comptes rendus* of the French academy, Dec. 1. On Dec. 18, Dr. Hunter of Scotland, in making the announcement of the Swedish discovery to the Edinburgh geological society, stated that he also had found a Silurian scorpion during the summer of 1883 in Scotland; and I can now add the statement that a fossil scorpion has been found in the Silurian rocks of America, and at an earlier period than either the Swedish or Scottish specimen, as it was obtained by the discoverer on Nov. 10, 1882.

On June 8 of this year, Mr. A. O. Osborne of Waterville, Oneida county, N.Y., wrote me that he had that day sent me a small box of fossils which he wished me to name for him, mentioning a few of them as of "special interest, as they are the first of the kind that I have found." On opening the box, some two weeks after it arrived, I found among those of 'special interest' a nearly entire scorpion which measures a little more than one and a half inches in length, but wanting a part of the fifth, and all of the sixth, segment of the tail. The specimen is preserved on the surface of hard hydraulic limestone, and presents the dorsal side to view. It is extremely thin and compressed, and, as a part of the substance is removed along the right-hand side of the abdomen and over the entire portion of the tail shown, these parts expose the inside of the ventral surface. The specimen shows the Cephalothorax and the left mandible (1) in place; the left palpus entire, with its chelate process (2); the first walking limb on the left side (3), with an apparently *bifid* extremity; and parts of each of the other three limbs on the same side. On the right side the palpus is folded on itself, and is imperfect. On the Cephalothorax the eye-tubercle is distinctly visible, and the points indicating the ocelli are readily distinguished; the ridges marking the position of the lateral eyes are visible, but the ocelli cannot be distinguished. As the inside of the abdominal plates is seen for about one-third of their width along the right side of the specimen, the spiracles ought to be shown, if they ever existed. Points which may have been spiracles are faintly visible; but the actual openings must have been very obscure, if present at all. The crust of the specimen is smooth, and destitute of the elaborately granulose ornamentation which characterizes the Swedish specimen: consequently the obscurer features would be more easily detected. But the specimen being so extremely flattened and small, renders other features more difficult of recognition. There is one feature shown in which this species differs very materially from living forms of the group. The limbs are crowded forward. The coxa and second joint (trochanter) of the posterior limb appear from beneath the edge of the first dorsal segment, on the left side; the end of the second ventral segment (*b*) is equal in extent to the end of the second dorsal segment, and of the same length antero-posteriorly. In the

recent scorpions this segment is not visible in any position (at least, not in any which I have examined), there being only five ventral plates of the abdomen; while here there are six in sight, which are almost exactly coincident with the dorsals in position. Another feature, I feel, ought to be noticed here. In recent scorpions the tail-segments seem as if reversed in position; that is, when straightened out on a plane with the abdomen, what would appear as the dorsal surface is below, and the bend of the articulations is upward. In this one it has been exactly the reverse; the under surface, as shown on the specimen, presenting only the two longitudinal ridges, and showing also the sinus at the posterior part of the segments occupied by the chitinous portion of the joint. The Swedish specimen would also appear to present this feature, as the upper surface, as figured on Thorell and Lindström's plate, shows the four ridges of the dorsal side of the tail-segments. The proportionate breadth of the body would indicate the American individual as a female, as it is of an elongate, oval form, being half as wide across the fourth dorsal segment as the entire length of the abdomen.



The geological horizon to which this American specimen belongs is that of the water-lime group, at the extreme base of, or perhaps more properly below, the lower Helderberg group (equivalent to the Onondaga salt group of central and western New York), and is nearly the same as that from which the Swedish specimen was obtained, probably somewhat lower. The associated fossils are Eurypterus remipes DeKay, Dolichopterus macrocheirus Hall (only lately obtained from this locality), Pterygotus Osborni Hall, and Leperditia alta Conrad. In other parts of the state, other forms of Eurypleri are found; also Ceratiocaris, with a very few molluscan forms, — all indicating a marine deposit. The fossils associated with the Swedish specimen are closely similar to the above in part. But many of the brachiopods mentioned as occurring there are allied to forms occurring in beds below, while others would indicate a horizon of lower Helderberg age; so that we may infer that the two forms belong very nearly in the same position geologically.

The zoölogical affinities of the American scorpion very closely resemble those of the Swedish specimen; and it may, perhaps, be classed under the same genus, Palaeophonus. This, however, requires further study to determine. The specific relations are quite different; and I propose to designate it for the present by the name Palaeophonus Osborni, after its discoverer. A full description of the specimen, with illustrations, will shortly be given in a bulletin of this museum. It is possible this may have been a land-animal, like the recent scorpions, certainly the natural inference would be that it was; and the finding of an undoubted stigmata in one of the ventral plates of the Swedish specimen would certainly lend strength to the supposition. But on this American specimen, where one end of each of the ventral plates is exposed to view, the stigmata certainly ought to appear; but it would require so great a stretch of imagination to see them, that I prefer to leave them as extremely doubtful. There are, however, along the left side of the body, at the junction of the dorsal with the ventral plates, in what should be the flexible chitinous membrane of the four stigmatic segments, what might very readily be interpreted as stigmatic openings(c); but these are so anomalous in their position that I have as yet felt uncertain of their nature, and also of the terrestrial character of the animal.

R. P. Whitfield.

Amer. museum natural history,
New-York City.

AN EVENING IN CAMP AMONG THE OMAHAS.

We had just finished our supper in the long conical shadow of the tent; and, the dishes being disposed of, we settled ourselves for the

evening chat. While Ma-wa-da-ne was filling his pipe, the other four men disposed themselves comfortably preparatory to the enjoyment of the smoke. Te-me-ha, with her usual industry, had spread upon her lap the brilliant-colored porcupine-quills with which she was embroidering a pair of moccasons, while old Me-pe sat rocking to and fro, and dividing her attentions between the gay-colored quills and the fringe of my wrap. After the ceremonial round of the pipe, I said to the men, —

"You do your share in this embroidery, since you capture the porcupine. Tell me about hunting them."

After a few moments of silence, a smile that broadened into a quiet laugh stole over Ma-wa-da-ne's face; then tightening his blanket about his bent knees, and giving a little shake of the shoulders to settle himself, he began, —

"The porcupine is a great digger, and makes a hole large enough for a man to crawl in. He likes best to live on the brow of a sandy hill, where there are no hollow trees. We hunt them with a long crotched stick. This we thrust into the hole until it strikes the animal; then we twist it to snarl it in the quills and fur. When we think the stick is well caught, we begin to pull gently to draw the animal out. Sometimes the stick loosens, and only the fur comes; then we have to try again, and get a better hold. When the animal is successfully brought to the opening, we look for his head, and give it a sharp, hard stroke with a stick which we carry for the purpose, and so kill him. We then have to skin him, and the women take what they want of the quills."

The smile had faded during this practical talk, but it returned as Ma-wa-da-ne resumed, —

"There were two Poncas who married sisters. The wives were fond of embroidery, and used so many porcupine-quills that it was hard to keep them supplied. One day they were at work, when they discovered they would very soon be out of quills, and each wife began to tease her husband to go hunting for porcupine. The young men were newly married, and wanted to please their wives: so, after enjoying the teasing a while, the men started, each going his own way toward the sand-hills. As one of them sped along, he noted near the top of a hill the large hole of a porcupine. As he approached the opening, he saw that the hole ran through to the opposite side of the hill. He thrust in his stick to search for the lateral burrows, hoping to find the animal. Creeping into the opening himself, while he was thus engaged, the entrance from the opposite side of the hill slowly darkened, and he discerned, to his consternation, the figure of a man. Not knowing whether this apparition might be friend or foe, he concluded to keep perfectly still. While thus watching, he felt a stick gently strike his breast; then, with more force, it began to be twisted. He seized it in his hands, holding it firmly, when the holder of the stick began to pull. The man in the hole allowed his arms to be stretched forward a little, and then dropped the stick. By repeating this operation, the outside hunter's enthusiasm was aroused, and he exclaimed, 'He must be a big fellow!'

"The man in the hole recognized the voice of his brother-in-law, and fear gave place to the desire to play a trick. After baffling the hunter for a while longer, the man crept slowly toward the opening, keeping tight hold of the stick as he advanced, while the hunter kept twisting to make sure of his game. The entrance reached, the make-believe porcupine plunged suddenly forth, exclaiming, 'What do you want?'

"The terror-stricken hunter dropped his stick, his excitement being too great to recognize his relative, and ran crying, 'Grandfather, have mercy on me!' A shout of laughter from the 'grandfather' made the hunter turn, and he, too, joined in the laugh."

When the merriment over the story had subsided, Sin-da-ha-ha remarked, —

"We catch rabbits and raccoons and skunks in the same way. The skunk hears the hunter advancing; and the animal will sometimes come near the entrance of his hole, and pound with his feet, making quite a loud noise, hoping to scare us. When we have thrust in our stick, and twisted it well in the tail, we draw the skunk near the entrance; then we put our arm in the hole, and grasp him tightly around the hind-quarters, pressing the tail firmly against the body; we then draw him out, striking the head quickly to prevent the animal biting. Sometimes we find eight or ten skunks in a single hole, each one of whom will try his charm of drumming on us. Young men like to wear gaiters made of the skunk-skin," turning, as he said this, to the youngest member of the party, to whom I said, —

"You tell me a story now."

In a few moments the young man began, —

"When I was young [here the old men shouted, but the young man with a merry twinkle in his eye went on], "I was very observing. One day I was looking about me, near the slough back of father's, when I noticed a frog hopping very fast. Suddenly he stopped, and picked up a stick three or four inches long,

and turned, holding it firmly in his mouth. I saw he was being closely chased by a water-snake who tried to swallow the frog, but the stick in the frog's mouth caught in the jaws of the snake. Several times the snake withdrew, and tried to attack the frog from the rear; but he would jump around, and immediately face the snake again. This happened several times; and at last the snake got tired, and slipped off in the bushes, leaving the frog victorious."

"Pretty good," said Wa-ja-pa. "I'll tell you something. Once late in the fall, Badger and I went hunting along the Loup River. We were afoot. We started up several elk, ran them down, and killed one. While I was butchering, Badger returned to camp for a pony to bring in the meat. After I had skinned the animal, and piled the cuts of meat on the skin, I lay down near by in the tall grass, and fell asleep. I was awakened by the sound of footsteps. Rising cautiously, I saw a large gray wolf standing near the meat. When he espied me, he began to growl, showed his teeth, and all the hair on his back stood up. Taking my gun, I levelled it at him, and shot. He was a fine fellow, and, as he fell, I determined to have his skin at once. It was the work of a few moments to flay him. As I threw his skin to one side, the legs of the wolf began to twitch, and the blood to trickle. In a moment the wolf was on his feet, and walking off without his skin.

"I never have believed in dreams, or the wonderful animals they tell about; but, when I saw that wolf walking away, I felt uncomfortable, but I made up my mind to shoot again. I did so, and he fell, and walked no more."

"When I got there with the pony," put in Badger, "I saw the place where the wolf was skinned, and tracked his steps by his blood to where he lay dead from the second shot."

"I remember hearing," said the young man, "Ou-zu-ga-hae and his brother tell that once, when they were flaying a buffalo-bull they had just shot." Then, turning to me, he said, "You remember, we first cut the skin of a bull down the centre of the back, and take off one-half at a time. Well, when the men had one-half the hide off, up got the buffalo-bull, shaking his head and staggering forward. The frightened brothers ran away as fast as their legs could carry them. The bull went but a little distance, fell, and died. It was some time, however, before the brothers could make up their mind to go back and skin the other side of that animal."

Old Me-pe gave a twitch at my wrap, and said, —

"Can't you tell a story?"

"Yes," I replied, "I will tell you about a black hen I once had. A friend sent me a present of a pair of guinea-fowl. By and by the guinea-hen began to lay; and, as I wanted to be sure to raise some fowl, I put ten of her eggs under a little black hen. She sat patiently for three weeks (the time it takes chickens to hatch), but she had to wait another week for the guinea-chicks. When they came out, — little sleek brown things with yellow legs, — the hen was very happy. But she was soon a troubled hen; for, when she clucked and bustled and scratched for them, they all darted away and hid. In her astonishment, as she stood silently looking for them, they would gradually creep back. Then she would cluck and scratch again, desiring to give them something good to eat; but away would dart the chicks, leaving the hen alone. After several such experiences, the hen evidently thought it was the clucking that scared them: so, as she walked along with her brood, she would scratch, but make no sound. Still, every time she scratched, the chicks shot off and hid. Then she thought a second time, and determined to cluck and call them, but not to scratch. This suited the little guineas, and ever after that the black hen and her ten guineas walked among my flowers and vegetable-garden, doing no damage."

"I have heard white men say hens have no sense," said Wa-ja-pa; "but your hen knew something. Of all the animals, I like the beaver best. He is most like a man. He plans and works and builds."

"You wanted to see an artichoke: there is one," said the young man, tossing the little brown root into my lap. "Yesterday evening I found a field-mouse's nest, and he had stored many artichokes. I went back to-day to get you some; but the mouse had been busy all night, transferring his stores to a secret place. Although I tracked him, it was too bad to rob the little fellow: so I only took one for you." I dropped the root into my purse, where it lies to the present day. A. C. Fletcher.

THE MEXICAN AXOLOTL, AND ITS SUSCEPTIBILITY TO TRANSFORMATIONS.[1]

The prolonged researches of Miss Marie von Chauvin on the biological relations of the amphibians have led to most interesting results concerning the transformability of the Mexican axolotl. The observations published by this lady ten years ago proved that under certain conditions, and by certain treat-

[1] From the *Journal of science*, June, 1885.

it is possible to convert the aquatic axolotl, ing by means of gills, into the terrestrial Am- na, which breathes by means of lungs. Indi- differences, however, came to light which ded further inquiry. This has accordingly arried out, and Miss von Chauvin now lays her sions before the public in the *Zeitschrift für schaftliche zoologie.*

as soon found that younger specimens could e easily transformed than older ones; but even individuals of the same age great differences o light, depending upon the manner of treat- Thus axolotls can be more readily converted mblystomas, if they are kept in water contain- le air, and are thus compelled to come more tly to the surface, and to breathe with their Others, kept in richly aerated water, obtained iency of air through their gills, and were, in uence, less readily converted. It appeared, , that it is merely requisite to apply any exter- pulsion towards transformation up to a certain f development, and that, when this has been l, the animals arrive at the higher form with- further interference.

point of time when the axolotl has arrived so s metamorphosis as to have totally lost the of living in water does not coincide with the ion of the gills. On the contrary, the most bservations prove that the power of the axolotl in water may, under certain circumstances, be d for a long time in individuals which have completely adapted to a terrestrial life, and sappears after the first moulting. Various ex- nts with axolotls which had passed through ge proved indubitably that a return to their life had become impossible: they completed etamorphosis, even though all possible means ken for its prevention. On the other hand, s which had lived for months in damp moss, d breathed with their lungs but had not d their skins, felt completely at home as soon were returned to the water.

surprising fact induced Miss von Chauvin to e further experiments on the adaptive power axolotl, and in particular to attempt by suit- eatment a repeated transformation of these es from the lower to the higher stage, and back again to the lower. This interesting nent has, in fact, been carried out with a suc- result.

out entering upon an account of the means e precautions used, or a description of the vari- ges of transformation, we pass at once to the

axolotl lived altogether for three years and a The first fifteen months it spent naturally, and t any interference, in the water; its develop- was then artificially accelerated, and in twelve was transformed into a lung-breathing animal; n lived on the land for fifteen and a half s; it was next, during the lapse of six days, t back to the water, where it spent three and months; in the space of eleven days it was again so modified that it could once more live on the land, where it remained for rather more than six months, up to its death.

The power of adaptation to a change of medium was so distinctly marked in this animal, and was maintained for such a length of time, that Miss von Chauvin instituted a further experiment with axolotls, with the object of interrupting at pleasure the metamorphosis of these creatures, and suspending it for years, and subsequently testing their adaptability. For this purpose, served five axolotls, each about six and a half months old, in which the development of the lungs was easily so far accelerated that they could live on the land. At this stage the further metamorphosis was suspended by a low temperature, and by being placed during the night in water. Nevertheless, in one specimen there occurred quite unexpectedly, after the lapse of fourteen months and twenty-two days, the first moulting, followed by the further conversion into the Amblystoma form. The four others were kept, however, for three years and two months in the state of suspended metamorphosis. After the expiration of this time, the attempt was made to convert two of them back into axolotls, while two others were to pass on fully into the Amblystoma stage. The result of this experiment was affirmative. The first two specimens reverted to axolotls: of the latter two, one died, while the other became a perfect Amblystoma.

The three experimental subjects, whose metamorphosis was arrested on Nov. 8, 1879, were in good health in October, 1884, in spite of the most arbitrary interference with their natural course of development. The Amblystoma was indeed smaller than those which had been transformed previously; but it was nevertheless very active and greedy, and quite conveyed the impression of a healthy, well-developed animal. In the two axolotls also, the arrest of the metamorphosis remained without injurious consequences. They are well developed, and feel quite at home in their element. They can be distinguished from normal axolotls merely by a somewhat smaller size, and by a less luxuriant development of the external gills.

The results of these experiments show how exceedingly great is the influence of the surrounding medium upon the organism of animals. Of the most important agents, air, water, and heat, the last possesses indubitably the greatest power over the nature of the animal; and next after it comes the character of the medium in which the animal is compelled to live. The external conditions of life can transform the nature of an animal either by a sudden metamorphosis or by protracted action; but, in opposition to all these external agencies, there stands a powerful influence seated within the animal, and acquired by inheritance, which can, indeed, be modified to a certain degree, but never entirely suppressed. This circumstance explains both the many individual fluctuations in the result upon perfectly identical treatment, and the want of success of so many experiments.

Miss von Chauvin points out that the cases of

'neotenism' (persistence of embryonal forms) recently observed among the Urodela find at least a partial explanation in the artificial transformation of the axolotl as here described: for it has been shown that the tendency to continued development can be suppressed by suitable influences; and such influences may make their appearance naturally, and involve a persistence of the larval condition.

The importance of this series of investigations on the primitive transit of the vertebrates from the water to the land has been already pointed out. It must not be forgotten that the remarkable tenacity of life of the amphibians is a capital element, both in such natural transit and in the successful result of the experiments described. With insects the case is very different: their metamorphosis has in certain cases been suspended, both naturally and experimentally; but all attempts which we have made to induce the reversion of an insect to a larval condition have so far miscarried.

HAS MAN A TAIL?

Has man a tail? It is a question under dispute. Anatomists have failed to agree as to what constitutes a true tail. A tail is generally understood to be a distinct posterior prolongation of the body, containing a greater or less number of vertebrae. This at once excludes all the cases of a caudal appendix of a fleshy character, such as are found among the rarer abnormalities of human structure. Where does the tail end in front? The comparative anatomist is obliged to designate all the vertebrae behind the sacrum as caudal; so that we are led to the conclusion that the four or five vertebrae of the human coccyx constitute a true though not a protuberant tail. In the embryo, however, during the second month of gestation, the coccyx does form a distinct conical projection, which properly answers to all the requirements of a true tail; so that there can be no question that man has a genuine though rudimentary tail, — a survival from his simian ancestors.

But as man is descended from long-tailed animals, we ought to find evidence in the human embryo of additional vertebrae. Professor Hermann Fol of Geneva has shown (*Comptes rendus*, 1885) that this is the case. He has found, that, besides the thirty-three or thirty-four vertebrae which persist into adult life, there are other temporary ones. In an embryo five and six-tenths millimetres (about twenty-five days), Fol found only thirty-two vertebrae: Prof. W. His had found thirty-three vertebrae in an embryo a little larger, — seven millimetres. This led Fol to suspect that there might be a still further increase, although in the adult there are only thirty-three or thirty-four vertebrae. He examined two embryos of eight or nine millimetres. One of them was divided into a series of three hundred and twenty sections, and every section was drawn with a camera lucida. Upon counting up the series, it was found that there were thirty-eight vertebrae. Comparison with other embryos satisfied Fol that this condition was perfectly normal. With the exception of the last two, all the caudal vertebrae had a blastema like their anterior fellows. The last two segments were indicated only by the perfectly distinct muscular segments (myotomes). The extremity of the tail was formed solely by the medullary tube, covered only by the skin. The notochord extended almost to the end. The terminal vertebrae have only an ephemeral existence. In embryos of twelve millimetres (six weeks) the thirty-sixth to thirty-eighth vertebrae have fused into a single mass. In embryos of nineteen millimetres the last five vertebrae have apparently fused to make the permanent thirty-fourth. C. S. M.

ETHNOGRAPHY OF ANTARCTIC AMERICA.

No inhabited land is found within the antarctic circle; and the title which the learned 'secretary-general of the ethnographic institution' of France has given to his memoir may therefore seem not strictly warranted. But, in the more general sense in which 'arctic' is applied to climate as synonymous with 'wintry,' the epithet 'antarctic' is sufficiently appropriate to the only region of the southern hemisphere in which the climate is severe enough to exert a controlling effect on the habits and character of the people.

Two years ago a little group of Fuegians, comprising four men, four women, and three children, were brought to Paris, and placed, as so many anthropological exotics, in the 'Garden of acclimation.' There they remained for several weeks, and were visited, of course, by many men of science. M. de Lucy-Fossarieu had already made a study of the tribes and languages of California, and naturally did not neglect the opportunity of examining the natives of this more peculiar and less known region. He saw them frequently, and gained much novel information, which considerably modified the opinions previously entertained respecting this people. He was led to examine the works of earlier observers from the time of Magellan to our own, and to gather from their descriptions, combined with his own observations, a view as complete as can now be attained of the ethnology of the southern extremity of our continent. Such, it appears, was the origin of this memoir, for which students of science are under great obligations to the author. It displays in a marked degree the qualities of clearness of statement, and accuracy of deduction, which distinguish the works of the best French investigators. A summary of its contents, with some additions derived from personal observation of the country and the people, will serve to show the importance of the conclusions which the latest evidence tends to establish.

The Rio Negro, a navigable stream of considerable length, divides Patagonia proper from the territories of the Argentine Republic. From this river to the

Ethnographie de l'Amérique antarctique: Patagons, Araucaniens, Fuégiens. Par P. de Lucy-Fossarieu. 4°.

Straits of Magellan, the country is inhabited by two distinct races, — the Tehuiliches, or true Patagonians, who roam over the vast and arid plains and uplands stretching east of the Andes to the Atlantic; and the Araucanians, who possess the strip of broken and rugged coast-land lying between that mountain chain and the Pacific. The languages of the two races belong to the polysynthetic or incorporative class, but otherwise differ totally, both in grammar and in vocabulary. A like general resemblance, with an equally marked differentiation in special traits, is noted in their other characteristics, physical and moral. The Araucanians, or 'Chileno' Indians, are well known, and have often been described. They are a people of medium stature, well formed, and bearing in their features and color, as well as in their character and habits, the typical characteristics of American Indians. Their energy and unconquerable valor have made them famous; nor only so, but, infused into their half-breed kindred, the Chilian people, these qualities seem destined to secure to that nation the headship of the South-American republics.

The Tehuiliches belong to what D'Orbigny has termed the Pampean race. Their congeners, along with some wandering tribes of Araucanian origin, are spread over the immense treeless plains of the Argentine Confederacy. From them the Tehuiliches, or proper Patagonians, differ mainly in the peculiar traits, bodily and mental, which they owe to the nature of the country they inhabit. This is, for the most part, little better than a stony desert, in which a tree is seldom seen, and only a scanty herbage here and there struggles into existence through the shingle which covers the surface of the land. Some lakes are found, mostly brackish; and a few rivers, fed by the snows of the Andes, traverse the country, and empty into the Atlantic. This monotonous and forbidding region, an antarctic Sahara larger than France, has a population of nomads whose number is supposed not to exceed ten thousand souls. Each individual has therefore a space of more than twenty square miles from which to derive his subsistence. Their food is altogether animal. Guanacoes and ostriches wander over the boundless plains. The Indians, on their fleet horses, run them down, and then capture them readily with their favorite weapon, the well-known *bolas*. Two balls of stone, or hardened earth, enclosed in leather, held together by a thong, are whirled around the head of the pursuing horseman, and then launched with such force and accuracy as to strike down an animal at the distance of fifty yards. Horse-flesh also, in recent times, enters largely into the Patagonian diet. Like the Eskimo and other tribes of the far north, these natives are fond of fatty substances, which they frequently devour raw. Their strong food, of which there is rarely any lack, and their habits of constant movement in the open air, under a climate severe but not inclement, give them large and robust bodies. The tales of their gigantic stature, so often told and as frequently denied, are thoroughly investigated in this memoir, and with a result which will be interesting to anthropologists.

Careful measurements have been made in recent times, by different observers, of many individuals in various parts of Patagonia. The result is that the mean stature of adults (of both sexes, it would appear) is found to be about 1.78 metres, or five feet ten inches English. "This mean," remarks the author, "may seem rather low; but if we compare it with that of France, which is only 1.65 metres (about five feet five inches), and if we consider that for all humankind the statistics give only 1.70 metres (rather less than five feet seven inches), we shall perceive that this figure represents in reality a very lofty stature, and makes the Patagonians the tallest race of men now existing." Men of six feet French (six feet three and a half inches English) are common among them; and occasionally one is found who reaches two metres, or six feet six and a half inches.

This, however, is not all. The Patagonian, in the upper part of his body, is of a huge build. His trunk and head are large, his chest broad, his arms long and muscular. On horseback, he seems far above the ordinary size of man. When he dismounts, however, it is seen that his legs are disproportionately short and slender: they frequently bend outward. His walk is heavy and lumbering. These are the well-known peculiarities which are found in the Tartars, and in all races of men who spend most of their time, like the Patagonians, on horseback. But it is only a little over two centuries since the horse was introduced into this region. The natives who were first seen chased the swift guanaco and ostrich over their immense plains on foot. Such activity required long, straight, and muscular legs. It is not too much to suppose that the total change in their habits of life, which has occurred since they became a nation of horsemen, has detracted at least two inches from their stature. Adding these lost inches to their present height, we recover the giants who astonished the companions of Magellan, and vindicate the narratives which later writers have discredited. We gain also a notable evidence of the influence of natural causes in modifying the physical characteristics of men.

The moral qualities of the Patagonians, as depicted by the author, are equally in harmony with their surroundings. Their tribes, scanty in numbers and widely scattered, rarely come into collision: wars are consequently infrequent. The more violent passions are seldom aroused. They are neither vindictive nor cruel. Their women are well treated. Like the men, they are good riders, and are, like them, tall, strong, and brave. If need be, they take part in fight beside their husbands and brothers. Children are the objects of singular tenderness. A whole tribe has been known to shift its location merely to satisfy the caprice of a child. The severe trials of their endurance to which youths, on arriving at maturity, are subjected among the fighting tribes of the north, are unknown among these peaceful nomads of the far south. It is hardly necessary to say that slavery does not exist among them, and human sacrifices are unheard of. Horses, in modern times, are frequently killed over the graves of their dead masters, and are sometimes offered in sacrifice to their divinities;

but the more usual offerings are the clothing and other wares which form their simple household wealth. These are usually hung upon trees, which, perhaps from their rarity, are deemed to have a sacred character.

Leaving these gentle giants, we cross the Straits of Magellan, and encounter what seems at first view to be a very different people. Voyagers who have touched at Tierra del Fuego have been accustomed to represent the natives as a hideous race, dwarfish and repulsive in appearance, and degraded in mind and morals almost to the level of beasts. This representation, in our author's view, is not a just one. Accurate measurements show that the average stature of the Fuegians somewhat exceeds five feet five inches English; which, the author remarks, actually surpasses a little that of the Araucanians. This average, of course, includes both sexes. Their squat appearance is due to their mode of sitting, in their canoes and their small dwellings, with their legs doubled under them. The limbs, retained long in this compressed position, become thin and bent. Otherwise the men are well formed, with broad chests and strong arms, and their features are not particularly unsightly. A large face, rather round than oval; prominent cheek-bones; a forehead wide and low; projecting brows; eyes small, black, bright, and restless; a short but nearly straight nose; a wide mouth with thin lips and strong white teeth, — compose a visage somewhat of the Tartar cast, not handsome certainly, but not specially forbidding.

Their nourishment is drawn mainly from the sea, with some variety from land-birds, and from penguins and other water-fowls. They spend much of their time in their canoes, which are ingeniously made of birchbark. The smallest are fashioned from a single piece taken entire from the tree, while the largest are composed of five or more pieces skilfully sewn together, and caulked with a species of resin. The large canoes are sometimes fifteen, and even twenty feet long. For transportation the pieces can be taken apart, and at the end of the portage can readily be rejoined and the caulking renewed. They usually carry a small fire at the bottom of the canoe, on a hearth of hardened clay. Their weapons and means of procuring food are the lance and sling, the harpoon, and the bow, the latter unknown to their Patagonian neighbors. The Fuegian bow is by no means the child's plaything which some voyagers have deemed it, who probably never saw it in use. One of the Fuegians in Paris could send an arrow, with simply a sharpened point of wood, through a board one-fourth of an inch thick at the distance of seventeen yards. Another arrow, discharged at the same distance, was buried so deeply in a tree that it could not be withdrawn without breaking. These arrows are usually pointed with flint, or, where it can be obtained, with glass. In the manufacture of these points, they display much skill. The only instrument employed is a long and narrow bone. The workman, holding this bone in his right hand, takes in his left the bit of flint or glass, which he presses firmly on his knee, and rasps violently with his implement, striking off a small fragment at every blow. Thus breaking away, bit by bit, the edges of the object which he holds, he brings it to the desired shape. Twenty minutes ordinarily suffice to complete the arrow-head. In all their other arts, of which they have not a few, the Fuegians show the same quickness and ingenuity. They have no pottery; but they make rush baskets, drinking-vessels of leather or of bark sewn water-tight, and little bags made of bladder, in which they carry their paints and their tinder. There is nothing in all this which seems to indicate in these natives any intellectual inferiority to the other aborigines of this continent.

The author holds that the Fuegians are mainly of the Araucanian race, but the scanty specimen which he gives of the language of those whom he saw seems rather to connect them with the eastern Patagonians. This, however, is a subject for future investigation. What is clear is, that the difference between them and their northern neighbors is due simply to the difference in their position and surroundings. Inhabiting a broken country, — an archipelago composed partly of marshy plains, and partly of rugged mountains; a region deluged by almost incessant rains, and swept by frequent and violent storms, — they have, of necessity, ceased to be hunters, and have become a race of fishermen, deriving a scanty and precarious subsistence from the tempestuous seas which encircle them. Scattered in small bands, composed each of a few families, they have no occasion for chiefs, or for a regular form of government. In this respect they resemble the Eskimo; and, like them, they retain, in spite of this isolation, some of the best qualities of social man. They are pacific in temper, are fond of their children, and hold age in much respect. Like the Eskimo, when brought to a civilized country, they display an intelligence and a good disposition which surprise and gratify their hosts.

Every now and then we receive accounts of savages, who, in intellect and moral qualities, as well as in aspect, are but little above the brutes. Unscientific observers, imbued with the pride of race and the prejudices of civilization, or theorists viewing everything through the colored medium of an hypothesis, who cast upon these savages a hasty glance, pronounce them to be a sort of connecting-link between man and the lower animals. These unfortunate creatures are found at one time in Australia, at another in the Andaman Islands, and again in South Africa. Sometimes they are Negritos in the East-Indian archipelago, and sometimes Botocudos in Brazil. Then comes the patient missionary, or the discerning and impartial man of science, like the author of this memoir, and enables us to see that these despised beings are simply men of like nature and capacities with ourselves — restricted and hampered, of course, by their environment, but capable, under better auspices, of rising to the same level of enlightenment which has been attained by the more favored races. The important truth embodied in the motto of the Société d'ethnographie (surrounding three figures of different race-types) — '*Corpore diversi, sed mentis lumine fratres*' — is strikingly illustrated by the facts set forth in this valuable essay. H. Hale.

ASTRONOMICAL NOTES.

SINCE the resignation of J.-C. Houzeau as director of the Royal observatory of Brussels, the management of its affairs has been in the hands of a commission consisting of Liagre, Mailly, and Stas. Mr. F. Folie, of the university of Liége, has lately been appointed the director of the observatory.

The journal *Ciel et terre* claims for Royers, a Belgian engineer, the credit of the first suggestion of the device now known as the 'floating dome,' of the form lately built for the observatory at Nice, France. Royer's connection with the subject dates from the year 1880, while letters-patent were issued to a well-known American engineer, covering a device much the same in principle, as long ago as 1863.

The bi-annual meeting of the Astronomische gesellschaft of Leipzig will this year commence on the 19th of August, and continue several days. Several American members of the society will be present at the session, and among them Professor Newcomb, who is now making a tour of the north European observatories. The society meets this year at Geneva.

We learn from *The observatory* that a very laudable effort at teaching the general public astronomy is being made in Christiania. An optician, A. Olsen, has erected a great refracting telescope in the Royal park. For a small fee, any one can observe the celestial bodies with this instrument, and receive instruction and explanations of their nature. The interior of the pavilion in which the telescope is mounted is hung with celestial charts and diagrams, also views of the sun, moon, and planets for facilitating the study of the various objects. This telescope is said to be the fifth in size at present in existence, and its cost was nearly ten thousand dollars.

In *The observatory* for July, Prof. E. C. Pickering of the Harvard-college observatory publishes the results of photometric observations of Ceres ①, Pallas ②, and Vesta ④, with the meridian photometers of the observatory. For Ceres, the mean result for nine observations is 7.71 ± 0.05 magnitude; and for Pallas, 8.55 ± 0.02. These observations were made in April and May of the present year, while in 1880–82 observations of Vesta were made which gave the result 6.47 ± 0.04 as the magnitude of the planet for mean opposition.

In addition to minor matters, the last annual report of Prof. C. Pritchard, the Savilian professor of astronomy at the Oxford university observatory, states that the memoir on the evidences of mutual gravitation among the components of the group of the Pleiades has been published by the Royal astronomical society; that the photometric survey of the relative lustre of all stars visible to the unaided eye between the north pole and 10° of south declination has been completed with the wedge photometer; and that an examination is now being conducted with reference to ascertaining the relative capacity of two large telescopes — the one a refractor of twelve and a quarter inches aperture, and the other a silver-on-glass reflector of thirteen inches aperture — for the transmission of light.

In the correspondence of a late number of *The observatory*, Mr. W. T. Lynn directs attention to the fact that an erroneous impression has widely prevailed, and is still to be found in many even of the most modern works in astronomy, that Bayer, in affixing Greek letters to the principal stars in the different constellations, arranged them strictly in the order of the alphabet. This error is to be found in Dr. Ball's 'Elements of astronomy,' in the article 'Astronomy,' of the ninth edition of the 'Encyclopaedia Britannica,' and in Chambers's 'Handbook of descriptive astronomy,' and elsewhere. An examination of Bayer's 'Explicatio' sufficiently indicates that such was not the course adopted by him; and this was also pointed out by Argelander in his academic dissertation, 'De fide Uranometriae Bayeri,' published at Bonn in 1832. Bayer divides the stars in each constellation into classes of magnitude, according to the ordinary principal divisions. The stars of the highest order of magnitude in each have assigned them that number of the first letters of the Greek alphabet; those of the next, their number of the next following letters; and so on. But no attempt was made to arrange the stars in each class according to their respective magnitudes; or rather, as Dr. Gould expresses it, "For the stars of each order, the sequence of the letters in no manner represented that of their brightness, but depended upon the position of the stars in the figure, beginning usually at the head, and following its course until all the stars of that order of magnitude were exhausted."

The Rev. Mr. Saxby of the Royal astronomical society has arranged for a summer's outing in the high Alps, and will use a six-inch equatorial at an elevation of 5,300 feet; also he has arranged for a series of observations on the Schwarzhorn, at an altitude of 10,400 feet, and is supplied with a spectroscope ranging from A in the red to well below the H lines, and calculated to do good work.

LATE NEWS FROM ALASKA.

MIDSUMMER advices from Alaska report that the military party on the Copper River are advancing toward the Yukon. The navigation of the stream is said to be very difficult. Copper ore had been found, but not conveniently situated, nor in so large quantities as had been supposed. The salmon-canning industry was flourishing, especially at Karluk and Cook's Inlet. The first shipment was made July 1. Robert King, formerly of Unalashka, noted for his kindness to scientific travellers in the territory, and who had made useful contributions to local meteorology and geography, died suddenly, May 29, at Sannakh Island. He was an Englishman by birth, and leaves seven orphan children.

The volcano island of Chernabura, or St. Augustin, in Cook's Inlet, is reported to still pour out smoke and steam from innumerable fissures. A hunting-party stationed there this spring reports

great difficulty in securing water enough to quench their thirst, or fit to drink. Fragments of the rock are reported to be frequently permeated with sulphur, and to present the appearance of a calcined rather than a lava rock.

The hemlock of south-eastern Alaska has been favorably reported on by tanners as unusually rich in tannin. Important beds of white marble have been reported from several points, and will eventually be found, probably, scattered through the coast-region from Port Mulgrave to the eastern boundary. That at Sitka, though never worked, has been frequently visited. That near the surface is inferior, but experts predict an improvement farther in.

The extension of the government over the territory proceeds very slowly. Loud complaints are heard from various quarters, that, as at Kadiak, no official intimation of the organic act promulgated in May, 1884, has yet been received. There is no doubt, that, as in previous dealing with our northern colony, an official lassitude has prevailed, for which various explanations are confidently offered. It is to be hoped that new appointments, when made, will, as in the case of the new executive, be of men qualified by energy and acquirements to advance the interests of the region. It certainly cannot be a benefit to any territory, that officers who are drunkards, ex-convicts, or employés of a private monopoly, should represent the government. Meanwhile the eastern part of Alaska has become the scene of pretty active antagonisms between miners, traders, and missionaries. Theoretically, every man is in favor of missionary work; but when, as in the present case, they take up available land for their schools, teach the Indian to work, and to build civilized houses, to ask a good price for his furs and fish, and on no account to sell his young daughters to white men, as was formerly the practice, — such innovations do not meet with universal favor.

The Patterson is surveying in the eastern district for the coast survey. Commander Coghlan, U.S.N., has furnished a number of useful reconnoissance sketches of harbors, straits, etc., which are being issued by the coast survey, together with sailing-directions.

THREE PHYSICAL TEXT-BOOKS.

Every teacher of physics is familiar with the looks of the old-fashioned text-book of natural philosophy. In the early pages come a picture of a wagon on a hillside (a pretty picture, if not for the marring parallelogram hanging from the back), and an air-pump of a pattern only found now as a pair of dingy brass cylinders wabbling on what was a 'highly polished' mahogany base; and, further on, an electrical machine is figured, and such an electrical machine as Franklin might well have called 'a vaste improvement.' The text matches the cuts, — an array of facts and figures derived from experiments long since superseded.

The question has been raised whether the modern knowledge can be made to take the place, in the mental drill of the schools, of the course so long honored. In the old 'Natural philosophy' the facts were so baldly stated, and were served in such a convenient shape for memorizing by the measureful, that it is not strange that one not especially attracted to the study should be able to say, in his after-school years, that he did not remember one word of it all.

There have cropped up, of late years, two kinds of physical text-books in place of the one now fortunately passing off the stage. It is hard to say which is first. There is the book intended as a guide in the laboratory, and of this class is the 'Practical physics' of Stewart and Gee; and there are such books as 'Properties of matter,' and 'Recent advances in physical science,' by Tait, which are meant as true 'text-books' for the capable teacher. It would never do to place either of the last two books in the hands of a machine teacher. A fearful medley of ideas would arise if the pages of 'Properties of matter' were dealt out by the measured stint to be 'learned;' and with 'Recent advances,' it must be feared that the result would be *nil*, so far as the education of the pupil went.

But with a proper guide, one able to introduce a few experiments to illustrate the points in discussion, to refer occasionally to collateral matters, and to hold up one end of a discussion if such should fortunately arise, either of the books by Tait will be found a true natural philosophy. The 'Properties of matter,' treating as it does of hypotheses as to the structure of matter, time, and space, gravitation, elasticity, compressibility of gases, liquids and solids, and of capillarity, and the phenomena of diffusion, will be found full of pithy, suggestive material, — material which will give rise to discussion, and which can be reasoned upon and talked about. The book is one which can be readily used to give the subject of physics a live interest for the instruction in the classroom. It is to be regretted that the author has opened the book with two chapters which are of 'a very miscellaneous character;' and it is not easy to understand why reference to equipotential lines

Lessons in elementary practical physics. By Balfour Stewart and W. W. Haldane Gee. Vol. i. General physical processes. London, *Macmillan*, 1885. 16+271 p., illustr. 12°.

Properties of matter. By P. G. Tait. Edinburgh, *Black*, 1885. 8+320 p., illustr. 12°.

Lectures on some recent advances in physical science, with a special lecture on force. By P. G. Tait. London, *Macmillan*, 1885. 3d ed. 20+368 p., illustr. 12°.

should be made, as it is, at the end of the chapter on time and space. But, leaving aside all captious criticism, it is safe to say that 'Properties of matter' is one of the best introductory text-books of physics of which we are as yet possessed.

Whether the lectures on 'Recent advances in physical science' can be used in the class-room, may be questioned. Of the value of the book for collateral reading, there can be no question. This is well enough shown in the fact that we now have the third edition. The desire to deduce much of our knowledge of physical principles from Newton's writings is apparent on many pages of the book, and has given rise to a discussion which is referred to in the preface.

The 'Practical physics,' of which we are promised three volumes, — the first only giving an account of general physical processes, — is intended as a guide for laboratory work. The explanations are clear, and the matter and instruments referred to are such as one actually meets in practice. The book is given up to a description of the ways to measure length and mass; the determination of density; the testing of the laws of elasticity, tenacity, and capillarity; and the measurement of atmospheric pressure, time, and the force of gravity. At the end is given an appendix on the selection, conduct, and discussion of operations suitable for the physical laboratory. The other volumes planned are to be devoted to electricity and magnetism, and heat, light, and sound. It is to be hoped that the succeeding volumes may equal that already published, which is the best book, for its purpose, we know of.

The school world is certainly to be congratulated on the addition to its literature of two such books as 'Properties of matter' and 'Practical physics.'

METHODS OF BACTERIA CULTURE.

THE need of a book in English, giving information as to the best methods of bacteria culture and observation, is a growing one; and, before opening the work under consideration, we were led to hope that it would fill, in a satisfactory manner, the vacancy that now exists.

We are disappointed in it, however, and for these reasons. A large number of methods and materials are described, staining-fluids are given, and authors mentioned; but the whole is thrown together with little or no criticism, and the beginner is as likely to adopt the wrong as the right method of procedure. Particularly is this the case in that portion of the book giving the methods of staining the bacillus of tuberculosis. These methods have been pretty well tested and sifted out; and there is no reason why they should all be given at length, with no more criticism of their value than we find here. As far as investigation yet shows, Koch's or Ehrlich's methods are the ones which are to be absolutely relied upon. Gibbs's double method of staining is absolutely worthless, as the author should know.

The preface to the book states the author's hope that it will be of value to "American investigators, and assist them in adding their share . . . to the mass of facts concerning bacteria;" but surely it would have aided the student still more if he had been informed that all the materials for culture-media and staining-fluids can be obtained in this country as well as abroad.

The form of the book, being of thick paper, and opened with difficulty, is exceedingly inconvenient; and we cannot condemn too strongly the fact that over one-third of the space is taken up by the references, which are printed in the same type as the text.

The technology of bacteria investigation. By CHARLES S. DOLLEY, M.D. Boston, *Cassino*, 1885. 12+263 p. 12°.

THE PERMIAN REPTILES OF BOHEMIA.

OF this excellent work, we have now before us the first volume, and the first part of the second one, containing the Stegocephali Cope (Labyrinthodontia autorum); in all, two hundred and fourteen quarto pages text, and sixty plates, some of them folding. The present work is not only the best ever given on the subject, but one of the most valuable publications which has ever appeared in paleontology. The Lyell prize, awarded to the author by the Geological society of London, is one testimony to its excellence. The plates are among the best we have ever seen, and were all drawn by the author himself.

After an introduction showing the geological position of the fossils, a preliminary review of the fossils found is given, which consist of the following species: Stegocephali, 43; Dipnoi, 2; Pisces, 31; Insecta, 1; Arachnoidea, ?; Myriapoda, 3; Crustacea, 5; Mollusca, 1.

This is followed by a detailed history of the

Fauna der gaskohle und der kalksteine der permformation Böhmens. Von Dr. ANT. FRITSCH. Band i., ii., 1. Prag, 1879–85. 4°.

different systems proposed for the labyrinthodonts, forming a very convenient compilation for the student. The rest of the book is devoted to descriptions of the different families of the Stegocephali. The author concludes that the paleontological material is still too meagre to venture on a genealogical table, but promises to offer a comparative discussion at the end of the whole work.

The first part of the second volume contains the Dendrerpetondidae, Diplovertebridae, Archaegosauridae, Chauliodontia (Miall), and Melosauridae. In the beginning we find the remarkable note, that it is difficult to accept Cope's division into Rachitomi and Embolomeri, based on the characters of the vertebrae, because both kinds of vertebrae (rachitomous and embolomerous) can be found in the same animal. The embolomerous form seems to be developed in the caudal, the rachitomous form in the thoracic, region.

The question whether the hypocentrum or the pleurocentra constitutes the base of the vertebra is decided by Fritsch in the following way: A normal vertebra with *one* centrum never can be formed from a rachitomous vertebra, but only an embolomerous vertebra with two disks. The rachitomous form prepares the embolomerous, and it is not surprising that both forms exist in the same animal.

The following parts will contain the fishes and arthropods, and in the final part the general conclusions will be given.

Finally, it should be mentioned that galvanoplastic copies of thirty-five Stegocephali have been prepared by the author, which cannot be distinguished from the originals. They are obtainable at the low price of fifty dollars from the author, 35 Brenntegasse, Prague.

PRACTICAL BOTANY.

Teachers who carry their classes beyond the elements of analytical botany find the number of adjuncts at their disposal increasing rapidly, so far, at least, as histology is concerned. Beside general text-books of all grades, and the treatises, large and small, on the methods of microscopical work, explicit directions for the study of common representative plants are now published in several languages.

So far as a short course is concerned, the demand for laboratory directions is already well met by the botanical portion of Huxley and Martin's 'Biology,' which any capable teacher can bring to date by a few lectures, and supplement by synopses of work for a few additional plants, like Spirogyra, Aspergillus, and Penicillium; and it is doubtful if many courses offered in America are comprehensive enough to warrant carrying this part of the work further. Yet to students who have time for additional work in this direction, without the knowledge requisite for carrying it on independently, this little book of Mr. Bower's, which owes its origin to the same causes that produced Huxley and Martin, will prove exceedingly useful. If it cannot be said to equal Strasburger's 'Botanisches practicum,' it has the merit of being in English, and bears evidence of careful workmanship on every page, while it is sensibly bound for laboratory use.

A course of practical instruction in botany. By F. O. Bower, M.A., F.L.S., and Sydney H. Vines, M.A., D.Sc., F.L.S. Part I. Phanerogamae-Pteridophyta. London, *Macmillan & Co.*, 1885. 11+226 p. 16°.

NOTES AND NEWS.

The vessel Alert, sent to visit the stations established last summer in and *en route* to Hudson Bay, has been obliged to return by reason of the prevalence of pack-ice, the exhaustion of their coal, and certain damages sustained. She will start again; but those interested in the commercial route *via* Hudson Bay to Manitoba are much disappointed; and the return is generally regarded as evidence that such a route would be even more precarious and uncertain than its opponents have claimed.

— Dr. Elkin, in charge of the heliometer of the Yale-college observatory, has been engaged for nearly a year and a half past in measuring the group of the Pleiades, his original plan being to measure with this instrument the same stars which Bessel measured with the Königsberg heliometer about fifty years ago. Dr. Elkin has taken advantage of all the improvements in the instrument and the methods of using it which have been developed in the last half-century; and, in addition to the successful carrying-out of his carefully elaborated plan of triangulation, he has also been able to extend his work to a large number of stars which Bessel did not measure. The position-angle and distance of the Bessel stars from the large star Alcyone are included in the work. The results of this very valuable work cannot be fully discussed, and prepared for publication, until the positions of certain stars of reference have been obtained from the work of other observatories where they are now being determined. Dr. Elkin has also obtained measures of the distances of a number of craters on the moon from neighboring stars, on thirty-six nights, near the times of first and last quarter. The positions of these craters on the moon itself have been determined; also series of measures made of the diameters of Venus, of the outer ring of Saturn, and of the satellite Titan

referred to its primary. A registering micrometer has been devised, and, in the form constructed by the Repsolds, has proved a complete success, greatly increasing the amount of work which the observer can accomplish. Dr. Elkin proposes to devote the heliometer for a year and a half to come to investigations in stellar parallax. The plan of research mapped out and already commenced will, it is hoped, if carried to completion, furnish a reliable value of the relative parallax of stars of the first and eighth magnitude.

— The fourteenth meeting of the French association will take place, says *Nature*, on Aug. 12, at Grenoble. Verneuil, member of the Academy of medicine, will be president. The public lectures will be, 'On the new gallery of paleontology of the Paris museum,' by Cotteau, ex-chairman of the Geological society of France; and by Rochard, general inspector of the marine, on 'The victualling of France.' A large number of medical questions will be dealt with in the several sections of the congress. The Ferran cholera experiments are sure to be discussed at full length. Numerous excursions will take place in the Alps, under competent guidance, as far as Chambery.

— An abstract of the second report of Albert Williams, jun., on the mineral resources of the United States for the years 1883 and 1884, has been issued in advance of the report itself. From the abstract we condense the following table, giving the value of the

Substance.	Value.			
	1880.	1882.	1883.	1884.
Coal	$94,567,608	$146,632,581	$159,494,855	$143,768,578
Pig-iron	89,315,569	106,336,429	91,910,200	73,761,624
Silver	41,110,957	46,800,000	46,200,000	48,800,000
Gold	33,379,663	32,500,000	30,000,000	30,800,000
Petroleum	24,600,638	23,704,698	25,740,252	20,476,294
Building-stone	18,356,055	21,000,000	20,000,000	19,000,000
Lime	–	21,700,000	19,200,000	18,500,000
Copper	8,886,295	16,038,091	18,064,807	17,789,687
Lead	2,102,948	12,624,550	12,322,719	10,537,042
Salt	4,829,566	4,340,140	4,211,042	4,197,734
Cement	–	3,672,750	4,293,500	3,720,000
Zinc	2,079,737	3,646,620	3,311,106	3,422,707
Mineral waters	–	–	1,139,483	1,665,490
Natural gas	–	215,000	475,000	1,460,000
Minor mineral products	3,387,444	15,995,830	15,841,664	15,205,464
	$322,616,480	$455,216,689	$452,204,628	$413,104,620

mineral products of the United States for 1882, 1883, and 1884 respectively; and to these we have prefixed the values obtained by the U. S. census for 1880, so far as known. No condensed table of quantities could be made, owing to the variability of the units of weight and measure employed. The great difference observable between the estimates for 1880 and those of later years is probably due rather to the methods employed for obtaining the mineral statistics, than to any such rapid increase in the value of the products as the figures would indicate. The amount of copper produced has steadily increased from 91,646,232 pounds in 1882, to 117,151,795 pounds in 1883, and 145,221,934 pounds in 1884; but the value of the product is less in the last year than in 1883. The value of the mineral waters produced in 1884 is over one and a half millions of dollars, nearly 69 million gallons being sold; while the amount of natural gas produced has been subject to a rapid increase, particularly during the years of the tariff agitation. The quantity of quicksilver produced has steadily diminished, while that of coal has increased. In the list of minor mineral products we have for 1884 such items as 2,000 tons of slate ground as a pigment, 35,000 tons of iron pyrites, 10,900 tons of felspar, 281,100 pounds of bromine, 10,000 tons of manganese ore, 147,410 pounds of mica, 431,779 tons of South-Carolina phosphate rock, 3,401,930 tons of limestone used as an iron flux, 875,000 tons of New-Jersey marls, 25,000 tons of heavy spar (barytes), 7,000,000 pounds of borax, and 1,800 troy ounces of aluminum. The general diminution in the total value of the mineral products of $3,012,061 from 1882 to 1883, and of $39,100,008 from 1883 to 1884, is due, as a whole, more to a decrease in price than to a decrease in the quantity produced.

— The Botanical club of the American association will hold its meetings during the week of the association, the hours and place to be announced on the daily programme, and not on Tuesday the 25th, as erroneously stated in the circular of the permanent secretary, and elsewhere. The first meeting will probably be on Thursday morning, Aug. 27, at nine o'clock. The club invites short and informal communications on any botanical subject of interest. This will obviate the necessity of presenting any but the most important and well-digested botanical papers before the biological section. Any person interested in botany who is also a member of the association may become a member of the club simply by registering.

— The chemical wonder of the London inventions exhibition is said to be the manufacture of oxygen by the process of Brin frères. They have made what is really an artificial mineral lung of anhydrous oxide of barium; and with this, by an ingenious process, they simply take up the oxygen from the atmospheric air. First, the air is drawn, by means of a partial vacuum, through a vessel of quicklime, which absorbs all the carbonic acid and moisture, and reduces it to a mixture of oxygen and nitrogen. These gases are then drawn into the retorts, heated at 500°, and the artificial lung absorbs the oxygen, while the nitrogen is drawn off to a gasometer for conversion into ammonia, etc. The Brins have, for the first time, made the artificial lung indestructible. The use of baryta for the purpose is not unknown; but hitherto the baryta has been perishable, and has required renewal every four and twenty hours, at great expense. They make it virtually indestructible and unchangeable. In this way they claim to have effected an absolute revolution in chemistry: for with a lung for the machine, and the atmospheric air for the material, they can make just as much oxygen as they like; and its uses, present and prospective, are almost innu-

merable and incalculable. For ventilation, aerating water without carbonic acid, for increasing the heat of blast-furnaces and the light of lamps, its uses are self-evident. The nitrogen, which was at first looked upon as wasted, has, by a process due to the same inventors, been turned into ammoniacal salts for manure. Most of the uses of these products were known. What is claimed is the almost fabulous reduction in the cost of production. The chemical text-books, according to Messrs. Brin, are at fault as to the possibilities of baryta. They all teach that it is destructible; and the Brins maintain, that, as they know how to treat it, it is indestructible. Oxygen in large quantities means a revolution in half the processes of chemical industries.

— Before the Amherst-college science association (see *Science*, v. iii. p. 340), the following addresses have been given, and papers read, during the past year: German university life, by G. G. Pond, M.A.; Origin of the vertebrate type, by Prof. J. M. Tyler; The chemistry of photography, by H. B. Ames; Artificial diamonds, by E. H. Smith; Chemistry and its relations, by Prof. E. P. Harris; Post-routes during the siege of Paris, by W. I. Fletcher, M.A.; Atomic weights, by W. H. Hallock; Relation of literature to science, by President J. H. Seelye; Torpedoes, by J. W. Morris; Relation of the mind to the body, by I. H. Upton; Storms, by A. F. Stone; Geology of regions about the Rhine, by Prof. B. K. Emerson; Marriage, by Dr. E. Hitchcock; Labrador, by W. A. Stearns; Astronomical photography, by Prof. David P. Todd; Nebular hypothesis, by Prof. B. K. Emerson; Migration of birds, by F. T. Jencks; Relations of animal to human psychology, by Prof. J. M. Tyler; Geology of South Africa, by B. N. Bridgman; How to choose a physician, by Dr. H. H. Seelye.

— The geological survey of Pennsylvania has now collected the various maps of the Panther-Creek and other coal-basins of that state, to form part i. of its 'grand atlas' of the anthracite coal-fields. It contains twenty-six sheets relating to the eastern end of the western, middle, and southern fields in four counties of the eastern part of the state. They have been published before by instalments, and noticed by us at different times; but their collection into a single atlas marks a welcome stage of that part of the work, under the superintendence of Mr. Ashburner.

— Rear-admiral English, who was recently in the Kongo country, has made a report to the Navy department in regard to the advisability of establishing a commercial station at the mouth of the Kongo River, or of securing a limited district for a depot and 'factorial establishment' for American citizens in that region. He says that the investigations made by Commander Bridgman and U. S. commercial agent Tisdell show that all the available land has been acquired for the nation by the trading-house employees, and is held at extravagant prices. Under these circumstances, Admiral English deemed it unnecessary to take any further action, and was of opinion that to establish a proposed coaling-depot at the Kongo would be unwise and unnecessary. Admiral English quotes from a letter from Tisdell, in which he says, "The reputed wealth of the Kongo valley has been greatly exaggerated, and it will be an undesirable and unprofitable country for an American to make his home or to embark in any business enterprise. Between Vivi and Stanley Pool I saw on all sides misery, want, sickness, and death, particularly among the employees of the International association. The country does not and can not produce food for the white man to live upon, and barely produces enough for the natives." This opinion is confirmed by Commander Bridgman of the Kearsarge, who says that it would be unwise for the government to do any thing to encourage Americans to go to that region. Commander Bridgman has no faith in the future of the Kongo predicted for it by interested parties.

— At the meeting of the Gas institute held in Manchester, Eng., in June, Mr. William Gadd read a paper on the effects of heating air upon combustion. For a considerable period, on purely theoretical grounds, Mr. Gadd had strongly doubted the value of heated air at ordinary pressure as a means of intensifying or causing more perfect combustion. Recent investigations strengthened his doubts to an enormous extent. An observation made by Professor Dixon, in connection with some experiments on a certain regenerator-burner, in which he found that a small quantity of air let in at the bottom or lower part of the lamp much increased the intensity, produced a strong impression on his mind, and confirmed the views he had formed. He therefore resolved to devise some simple experiment which would determine the point. He employed many methods which showed, all of them, in some degree the expected result, and strengthened the belief in the discovery which theory pointed out. He was at last enabled to formulate a method to make the conclusions unmistakable and plain. He found a peculiar phenomenon of flame, which he termed 'a balanced flame of imperfect combustion.' In this he recognized the means for what he conceived to be complete demonstration of that which he had long suspected; namely, that, so far from the heating of air in passages at constant or ordinary pressure increasing combustion, it actually retarded or rendered combustion more imperfect. Mr. Gadd described his experiment, and produced before the meeting the 'balanced flame' he spoke of. His conclusions were strongly contested by several speakers.

— The slight epidemic of small-pox in Berne last winter has hastened the passing of the new vaccination act there, which differs slightly from the previous one. Vaccination is not to be invariably compulsory, a physician's recommendation being sufficient if dispensed with. As a rule, animal lymph, not human, must be used, and the consent of the parents is requisite. The state will provide the doctors with lymph, the doctors undertaking to vaccinate gratis. Any doctor can be prosecuted for injury caused by careless vaccination.

SCIENCE.

FRIDAY, AUGUST 7, 1885.

INTERNATIONAL SANITARY CONFERENCE AT ROME.

IDEMICS are not an unmixed evil. In- it would perhaps not be going too far y, that, on the whole, they are productive ore good than harm. They call attention nitary sins, and lead to sanitary reforms, , in the absence of such a special stimu- would often not be made. As a result of reforms, the mortality from endemic dis- is, no doubt, often reduced to an extent would quickly leave a balance on the side if a careful life-account were kept cholera or yellow-fever in areas outside eir endemic prevalence. Thus, for ex- e, the epidemic of cholera in Naples last has been the cause of a general sanitary ening in that city, which has long been as a hot-bed of typhoid-fever and other ntable filth-diseases. It has led to the ly completion of the new water-works, by h the city secures an ample supply of water; and the municipal authorities are earnestly inquiring as to the best system werage, with a view to introducing it as as possible. By the way, the writer sug- ed to the syndic (mayor), that the 'sep- system' of Col. Waring would be best ted to the special conditions found at les; and this suggestion received the in- ement of the famous Dr. Koch, delegate Germany to the International sanitary erence.

ne of the most prominent indications of general agitation of measures relating to ary reform, which in civilized countries ws an epidemic, is the disposition on the of a country which has been recently shed, to call upon its neighbors to make non cause with it against the deadly pes- e. Thus the International sanitary conference of Constantinople (1866), that of Vienna (1874), and that recently called by the Italian government, which met in Rome on the 20th of May of the present year, have all been the direct result of a recent epidemic of cholera; while the incentive which caused our own government to invite other nations to send delegates to the International sanitary conference held in Washington in 1881, was the epidemic of yellow-fever which devastated the Mississippi valley in 1878, and re-appeared in Memphis in 1879. The object in view on the part of the various governments which have taken the initiative in calling together sanitary experts for an international conference, has been to establish by treaty an international and uniform code of sanitary regulations. Unfortunately this object has not yet been attained. Whether the conference of Rome will be more fortunate in this respect than its predecessors have been, remains to be seen; as it has not yet finally adjourned, but is to meet again in the autumn. In the mean time, the delegates are to confer with their respective governments, and to present for their consideration the conclusions reached by a sub-commission composed of the technical delegates, which must serve as the basis of an international convention, if one is finally arranged. Even if this desirable result is not attained, the conference, like those which have preceded it, will be productive of great good, especially in the country where it was held. The interchange of opinions among leading sanitarians from various countries, the formulating of the knowledge which has been gained in the laboratory, or by the practical management of epidemics, the publication of explicit directions relating to quarantine, disinfection, municipal and maritime sanitary supervision, etc., cannot fail to be useful. And, even if no novel preventive measures have been brought forward, the reiteration, with the authority of such an assemblage of experts, of well-recognized san-

French delegates insisted upon dividing sengers into isolated groups, so that oup might be released separately at the on of five days from the occurrence of case. Other delegates objected to any n for a longer period than is necessary thorough disinfection of the vessel and sonal effects of the passengers. This l system of quarantine, or 'medical on,' if well executed, and with the ap- n of approved methods of disinfection, doubtless afford the greatest possible with the least possible interference mmerce, and injustice to individuals; s the old-fashioned quarantine is re- by the more enlightened nations of as untrustworthy and barbarous. Dr. he discoverer of the 'comma bacillus,' favor of the system of medical inspec- above defined.

ould be out of place in the present paper more in detail the conclusions reached conference with reference to sanitary ions to be adopted at the port of de-, at sea, and at the port of arrival, the measures recommended for the Red d Suez Canal, the directions for disinfec- tc. But, as showing in outline the gen- ntiment of the delegates with reference most important preventive measures, we quote the following proposition, which troduced on the last day of the session delegate from the United States, and dopted with but a single negative vote ey).

he measures recommended against chol- e, in general, applicable to yellow-fever, o other diseases which prevail in epi- form under the influence of bad sanitary ions, and which are transmitted by intercourse.

he most effectual means for preventing the gation of diseases of this class are: The y improvement (*assainissement*) of sea- owns, and of vessels sailing from infected isolation of the sick; and disinfection of d or suspected articles and localities."

more, July 30. GEO. M. STERNBERG.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

An abnormal Rudbeckia.

An interesting specimen of Rudbeckia hirta, L., was recently found among a patch of plants by my brother, Mr. Davis L. James. It differs from the normal type in such a manner as to deserve notice. It had the ordinary form, with the black conical centre. There were thirteen yellow rays. Two of these were of the usual shape, ligulate, with notches at the end; three were tubular, and with five lobes; and the remainder split open near the end, and the ray spread out. All the rays were *fertile*, although the generic character is 'rays neutral' (Gray, 'Manual,' p. 254). There can be no doubt as to the species, as it is a very common and familiar plant in this neighborhood. The sketch shows the appearance of the flower. It seems almost like an intermediate stage between the typical composite and a blossom with a number of large tubular flowers in a head. Can it be a reversion to some ancestral form?

JOSEPH F. JAMES.

Cincinnati, O.

The ginkgo tree.

Some years ago I received fruit from the Ginkgo (Salisburia adiantifolia) from Tennessee, and since then I have heard of a number of cases. My impression is, that, in the latitude of southern Pennsylvania and Virginia, it is rather common for this exotic to fruit.

WM. H. BREWER.

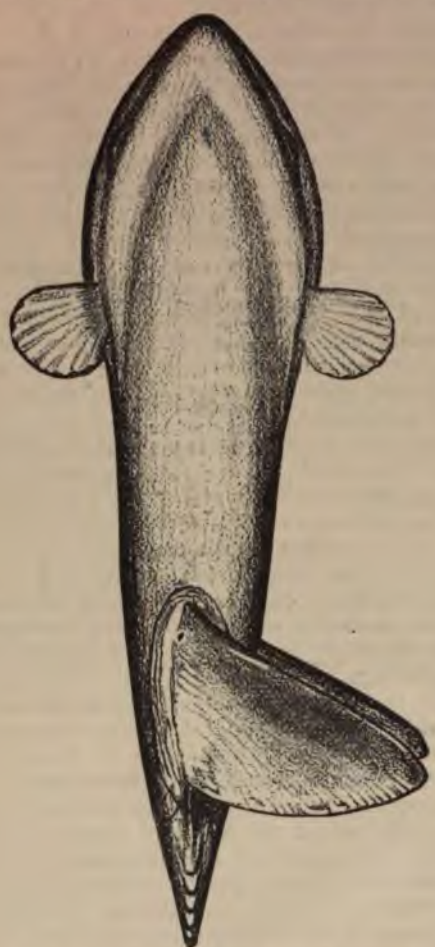
New Haven, Conn., July 28.

The swimming-habits of the sunfish.

The accompanying figure may at first puzzle the reader, but a little explanation will make it comprehensible. It is a view of the sunfish, or Mola, as seen from the back, the beholder looking down upon the animal from above as it swims in its own peculiar way. The individual from which this sketch was taken was caught in a trap-net at Quisset Harbor, Mass., and afterwards towed in a strong bag-net with a steam-launch from Quisset to Wood's Holl, where it was placed in one of the large pools constructed south of the laboratory for the Fish commission under the direction of Professor Baird. The fish measures about five feet in length and three in width: in fact, it may be considered adult. Since its removal to its new home, the animal seems quite contented, and has afforded an unusual opportunity to observe the manner in which its fins are used. The manner in which these organs are moved is so peculiar that it has been thought advisable to give a brief account of the means by which they are made effective as locomotive organs.

One does not need to watch this fish long in its

native element to discover that the great dorsal and anal fins are almost its sole organs of propulsion. In the figure, both are shown with their tips thrown over to the right side. This movement is synchronous in these great fins; that is, both strike in the same direction at the same time. But the most remarkable feature about them is, that they are twisted into the form of the blade of a propeller-wheel at the commencement of each stroke, as shown (not very clearly) in the figure, where the foreshortened dorsal is indicated in the condition which it presents at the moment



MOLA ROTUNDA (viewed from above, $\frac{1}{12}$ nat. size).

when the stroke to the left is about to begin. The direction of the peculiar twist of these fins is also reversed at each successive stroke, in opposite directions, so that a most effective propelling apparatus exists, which it would be somewhat difficult to imitate by a mechanical device. This contrivance is rendered all the more effective in consequence also of the great width of the fish, by which great stability is secured.

A very peculiar soft oval ring of dermal tissue around the bases of the dorsal and anal, renders them readily movable by means of the tendinous terminations of the muscles which are inserted into the strong bases of their rays. A similar band of soft dermal tissue is found on both sides of the base of the broad, crenulated, rigid tail, which is moved on its base just as the rigid rudder-blade of a vessel is moved by means of the rudder-chains. In the case of Mola, however, the single pair of rudder-chains as found in a vessel is replaced by a single series of tendons on either side of the median line, running parallel, and passing through round canals in the soft elastic base of the caudal, and inserted into the bases of the caudal rays.

The office of the curiously modified caudal of Mola seems to be solely that of a rudder, no vibration whatever of the tail being apparent when the animal is swimming in a straight line. Only when the creature wishes to turn is it deflected from the median line at its tip; and even then its apex sweeps through an arc of not more than twenty-five degrees at most, usually much less.

The pectorals are comparatively small, and, in swimming in a straight line, are extended horizontally and kept rigid and motionless by the animal, as if merely for the purpose of keeping the body vertical. When swimming with the sides of the body at an angle with the plane of the horizon, one or the other of the pectorals is folded closely against the side.

It thus becomes evident that Mola uses almost exclusively the dorsal and anal fins as locomotive appendages, and that the tail and pectorals act respectively as the rudder and as balancers, and take no active, but only a very subordinate, share in effecting the creature's movements. Even the rudder-like tail may be said to be defective; for it was noticed that the fish, when first placed in the pool, was unable to turn quickly enough to avoid bumping its snout against the stone walls at the angles of the enclosure.

The organization of this creature is probably the most remarkable of any encountered amongst the Teleostei. The body is incased in a very thick inflexible skin, and all of the lateral musculature has become subordinated to the office of flexing the vertical fins. In fact, so extreme has been the muscular specialization, that the myotomes have been entirely suppressed, and the lateral muscular masses developed into long muscles, ending in tendons.

No less remarkable has been the mode in which the tail has been developed through a larval form, probably provided with a lophocercal tail, which has already disappeared in the stage represented by Molacanthus. Mola, in fact, is the best-known example of a type having a gephyrocercal structure. No less extreme is the modification of the cerebro-spinal nervous system; for, as a result of the muscular specialization already noticed, the medulla spinalis has been excessively abbreviated. We are, accordingly, forced to admit, that Mola is the most extremely modified teleost in existence, notwithstanding the fact that a great many very singular deep-sea forms have been described within a very recent period.

The great advantage of having the large pools of salt-water enclosed by heavy stone walls also becomes very apparent in the instance of Mola, and shows how valuable they may become as aids in the study of the habits and modes of life of such large marine forms as dolphins, porpoises, sharks, swordfish, etc., — types in which the Fish commission is interested, as affecting the abundance of certain of the food-fishes.

JOHN A. RYDER.

THE FRENCH ACADEMY IN ITS ORIGIN.

"I UNDERTAKE, since you request it, to write down what I know of the French academy, — a society about which many people talk, but which few people know as it ought to be known."

These are the words with which Pelisson, the original historian of that famous society, began his narrative. Notwithstanding the charm of his graceful style, the exact additions to the record which were made by the Abbé Olivet, and the much more recent notes of Livet, to say nothing of Kerviler's readable bibliography, and Arsene Houssaye's witty and satirical criticism, the French academy remains to this day as it was in 1653, when Pelisson's story was first anonymously published, — "a society about which many people talk, but which few people understand." Now and then some enthusiastic English or American writer proposes an English or an American reproduction, or a critic skilled in the poise of conflicting ideas sets forth the possibilities and the difficulties of organizing such an imperial agency, amid the de-centralized institutions of Great Britain and the United States. Matthew Arnold concludes his famous essay on this subject by a sentence in which admiration is tempered with doubt. "An academy," he says, "quite like the French academy, — a sovereign organ of the highest literary opinion, a recognized authority in matters of intellectual tone and taste, we shall hardly have, and perhaps we ought not to wish to have it." We may venture to add, that, if London cannot have its literary court to exercise an acknowledged supremacy within a prescribed domain, New York and Washington must wait awhile before their political or financial power can originate a society which will be potent in the promotion of letters.

Nevertheless, the growth of the French academy, and its influence upon the scientific, as well as the literary, progress of France, are quite worth studying. It is the parent of the Institute of France, but it is the child of a modest coterie of literary people such as may be found in almost every cultivated town. Its extraordinary growth is due in no small degree to that innate love of symmetrical organization, or of good form, which the French exhibit in many phases of their activity. It owes not a little to the power of the monarchy in the days of Louis XIV.

The French academy is always spoken of as founded in 1635, but several years before that date its nucleus was in existence. As early as 1629, a number of bright men living in different parts of Paris, suffering from the social impediments of a great city, and finding it inconvenient to pay visits without finding their acquaintances at home, determined to have a weekly meeting at a private house. They were men of letters, above the average ability, associated like our literary clubs, by the principle of good fellowship, with the slightest possible regulations, and having at first no higher purpose than familiar and friendly conversation on business, news, and literature, the interview ending with a promenade or a collation. If any one of the company wrote something on which he wished genuine criticism, here was his opportunity to receive unguarded and honest comments. In later years the members of the academy looked back to this golden age of its infancy, when all that is bright and charming in literary society was enjoyed without noise, parade, or animosity. To avoid the intrusion of unwelcome fame, even the fact that there was such a club was for a long time not mentioned to those who were unconnected with it.

But such light could not long be hidden beneath a bushel. One by one, outsiders heard of that charming circle which was not engaged in the exchange of compliments and flattery, but which openly and boldly pointed out to the members their literary faults. All this Arcadian chapter is charmingly told by Pelisson, whose narrative we are following as others have so often done before. Boisrobert was then in high favor with Richelieu, — the one to whom the Cardinal's physician referred when he said, "Monseigneur, I can prescribe nothing more for you but two drams of Boisrobert after dinner." From this source the great minister of France heard of the brilliant coterie which met at the house of Conrart. The far-sighted sagacity of Richelieu perceived the possibility of giving public authority to these self-contained critics, and through Boisrobert he offered to become the protector of the club, and to give it the authority of *Lettres patentes*. His proposals were gladly accepted as honors from the crown, and after due deliberation and formalities, the charter passed under the royal hand and seal in the month of January, 1635. This document is far more interesting at this late day than most such official papers. It abounds in lofty sentiments admirably expressed. It recognizes the conferences which have been held by the pre-existent 'assembly;' it confirms and defines their purpose to be the promotion of eloquence, that is to say, of skill in the use of language; it bestows upon the

infant society the name which has now become historic; it limits the membership to forty persons; and it confers upon the chief and protector, Cardinal Richelieu, the authorization of officers, statutes, and by-laws. Various other names had been proposed, — l'Académie des beaux esprits, l'Académie de l'éloquence, l'Académie éminente, — but finally Académie française was selected, because it was more modest and more appropriate.

The original statutes define in much detail the sphere of the academy, and its methods of procedure. Its purpose is thus stated in the twenty-fourth article. "The principal function of the academy will be to labor with all possible care and diligence to give certain rules to our language, and to make it pure, eloquent, and capable of treating the arts and the sciences." In subsequent paragraphs, provision is made for the distribution of the best French authors among the academicians who are to make a note of such words and phrases as suggest general rules of correct expression, the entire academy being the judge of what is thus presented. The preparation of four works — a dictionary, a grammar, a rhetoric, and a poetry — is projected. At every regular meeting, one of the academicians, in his turn, is to present a discourse in prose, reading it or reciting it as he chooses. He may select any theme, but must restrict himself in delivery to fifteen, or, at most, thirty minutes. The rest of the session is to be devoted to the examination of works which have been presented to the academy, or to the prosecution of the four great tasks already mentioned. Every discourse before the academy is to be referred to two censors, who shall report within a month their observations upon it, and the author, within the following month, shall submit to the commissioners the corrections which he may have made in accordance with their suggestions. Similar steps are to be taken in respect to other works submitted to the judgment of the academy. Brief rules are laid down to make the criticism truly effective. The commissioners or censors are not to keep copies of the papers they examine, nor of their observations upon them; faults are to be pointed out with deference and courtesy. The corrections are to be received in the same spirit; the approbation of the academy will be expressed without praise, and in accordance with a prescribed formula. Works indorsed by the academy, after such scrutiny as has been mentioned, may be published 'by order of the French academy;' but no academician may indicate his membership in the academy on the titlepage of a work not submitted to the criticism of his associates, or not approved by their action. The rules which the academy prescribes in respect to language or orthography must be followed by all the academicians in prose and verse. All revelation of the confidences of the academy, in criticism or praise, is forbidden under penalty of disgraceful and irremediable expulsion.

By these severe methods, the literary men in Paris, in the middle of the seventeenth century, endeavored to hold themselves and their countrymen up to a high standard of literary excellence. The results have been apparent from that time to this, in the clearness, the fitness, and the grace, which have characterized French writers, not only those of genius and erudition, but those of humbler standing. In later days, other academies in Paris have shared with the French its lofty rank; and perhaps there is less reason now than there was two centuries ago, for such concerted action in the improvement of the French language, and in the promotion of a pure style; yet no one can read the story of those primitive days without admiration for the spirit which conceived this lofty idea of the benefits of literary criticism, severe and considerate, and which upheld the advantages of co-operative efforts in the advancement of letters. Among all the literary clubs of the world, none has attained to such acknowledged authority, none has come so near to immortality, none has had such wide-spread influence, as that which sprang into life at the magic touch of Richelieu two centuries and a half ago.

EXPLORATION IN INDO-CHINA.[1]

On the 12th of December, 1883, I left London for Liverpool, and embarked the next day for Rangoon.

Luckily I was introduced to the Rev. Dr. J. N. Cushing before leaving the steamer, and, as he was the best-known Shan scholar, and had previously traversed part of the country I intended to explore, I induced him to join my party. Having procured the necessary passports, and paid my official calls, I left for Maulmain to make arrangements for the journey.

On the 12th of January I sent my boys on with the luggage to Shwaygoon, a town some sixty miles distant from Maulmain up the Salween River, and followed with Mr. Ross, of the Bombay-Burmah trading company, on the 15th, in a steam-launch. The same day we left in carts for Hlineboay, where we arranged for hiring elephants for both of our parties. Returning to Shwaygoon, I made a boat-journey up the Salween as far as Yembine, to see whether it was practicable to carry a railway in that direction. On my return to

[1] From an article by Holt S. Hallett in the London *Graphic*.

Shwaygoon, on the 20th, I found that Dr. Cushing and the remainder of our party had arrived there. The next day we left with seven bullock-carts, and after a good ducking in the Hlineboay River, owing to our driver missing the ford, reached Hlineboay, where we found that the Burman magistrate had procured fourteen elephants, — six for our party, and

MAP SHOWING PROPOSED RAILWAYS.

eight for that of the Bombay-Burmah party, which wished to accompany us as far as Maingloongyee. As the latter party had not arrived by the 23d, I determined to start, and make short marches until they overtook us. Having secured a guide who could speak Burmese, Talain, and Karen, to come with us as far as Maingloongyee, we mounted our elephants, and I commenced the survey.

Mounting an elephant is no easy matter for a European. A native, with his bare feet and lithe body, just takes hold of the ear of the monster, and scrambles up; but we, with our boots and tight-fitting clothes, in vain attempt to follow their example. The hide is so slippery that we can get no purchase on it, and either have to be half lugged and half bundled up; or clamber from a stage on to the beast's head, and perhaps sprawl over the mahout as we attempt to enter the howdah; or else endeavor to mount by a rope-ladder, whilst the timorous elephant, unused to us and our strange appearance, is edging away, and may, in his fright, floor us with a swing of his trunk, and endeavor to make an end of us with his tusks.

I do not know whether any one before me ever attempted to make a route-survey from the back of an elephant: the difficulty of the proceeding can only be conceived by one who has tried it, particularly if the animal is a tall, long-striding brute. Female elephants are much pleasanter to ride than male ones; but, as a male elephant is considered superior, the natives insisted that I, being the head of a party that they wished to honor, should invariably mount the largest male tusker that they were possessed of. The weariness caused by the constant jolting that I suffered for months, joined with the constant wakefulness of my attention, left me nearly prostrate on my arrival at Bangkok.

Our first march was a short one. The elephants, after being unloaded, had their front feet shackled with anklets made of twisted cane, and were led away to their bath, and afterwards turned into the jungle to feed. The elephants had to be bathed and loaded by daylight, so that we might make long marches, and have a good rest in the heat of the day, when we took our breakfast. Before starting, we generally had some Kopp's soup mixed with Liebig's essence of meat, and some biscuits, with coffee, cocoa, or tea. Our breakfast, which we generally took about noon, consisted of soup, chickens, sometimes a duck, curry and rice, and vegetables when we could get them. Tea was always going, both for ourselves and our servants. At times we were so tired of fowls that we purchased cattle and had them slaughtered, as we could not otherwise get a beefsteak. Pork, even from wild boar, was dangerous food. Nearly all the people of a village we passed through in the Muang Fang plain were suffering from trichinosis, and most of the inhabitants in Viang Pa Pow had been taken ill about two years previously.

Our dinners were similar to our breakfasts, with the addition of fried plantains, tapioca, or boiled rice and jam.

Although deer were plentiful throughout the country, we seldom had venison, as we had no time to hunt. Often deer crossed our path right in front of our elephants, a wild boar would rush through our encampment, and jungle-fowl, quail, and hares be

PILLAR ROCK IN THE MEH PING.

met with in our day's ride. Gibbons were nearly the only monkeys that we ever saw, but they were very numerous in the evergreen forests.

Not only were fires lit for our dinners, but owing to the numerous tigers, which were constantly on the prowl at night in the neighborhood of our camps, often a dozen were kept burning all night long by

the Karens, who had charge of the elephants from Hlineboay to Muang Haut. The Shan drivers, who accompanied us on our other journeys, were not so fearful. We sometimes heard of tigers attacking oxen in villages on both sides of our camp, but we were so fortunate as to see no more of them than their footprints.

Our encampments were generally under the shelter of large evergreen-trees, at times upwards of twenty-four feet in girth, a hundred and fifty feet to the lowest branch, and from a hundred and eighty to two hundred feet in height. Our shelter, until we reached Zimmé, consisted of a frail structure formed of a few branches covered over with two waterproof sheets, slightly bent, so as to allow the heavy dew to drop off. Our howdahs, for this stage of our journey, were without covers: so we could not creep into them to escape from the storms that are frequent in the hills, even in the dry season.

Mr. Colquhoun has noted, in his most interesting work 'Amongst the Shans,' that Shamanism, or Nat worship, is not only the sole religion of most of the hill-tribes in Indo-China, but has been absorbed into the worship of the followers of Buddha. 'Nat' is the Burmese for the elf-folk, fairies, gnomes, and demons of our nursery lore. So real is the worship — or, rather, the belief in the power — of these beings, that all good and evil that occurs to mankind is put down to their direct influence or action. Wherever one goes, little doll-houses are found placed on small platforms of bamboo, with a few leaves, fruit, rice, flowers, or perhaps all together deposited in them, to keep the Nat, or Pee, in good temper. Their baneful influence is more feared than tigers; and every precaution was taken at all our halting-places to propitiate, appease, and ward them off. Mystic crosses of bamboo were stuck up at the paths leading to the camp; and, on sauntering round, many traces were seen of devotion to the Pee.

One peculiarity of the good and evil Pee, is that they are ancestral spirits, who become good or evil spirits after the decease of the human form which they inhabited. If a king or other ruler or nobleman dies whilst passing through the forest, his spirit must, of necessity, haunt the place where he died. No merit-making can arise from procuring religious services over his corpse. The disembodied spirit wanders about in his desperation, and endeavors to cause the death of all who pass his way. If he succeeds, the deceased's spirit has to become his companion and subject. Thus a clan, with its chief, is formed to entrap and kill all unwary passengers through the forest. No one dying in the forest has the privilege of returning home to join the household spirits: they are forever destined to be Pee Pa, or evil spirits of the jungle. The Pee Ka are wizard spirits of horse form, who are re-enforced by the deaths of beggars and very poor people, whose spirits were so disgusted with those that refused them aid in food and shelter, that they resolved to return and haunt their stingy and hard-hearted neighbors.

Leaving the British guard-house on the 28th, we arrived the next day at the Shan guard-house at Meh Tha-wa, on the Thoungyeen River, which here forms the British eastern frontier.

We clambered over the hills and spurs in the usual crow-flight of the Karens, and, descending into the valley of the Meh Nium or Maingloongyee River, reached Maingloongyee on the 5th of February. Here we put up at the house of one of our largest Burmese foresters, called Moung Hmoon Taw, who has worked the forests in the basin of the Meh Nium for many years. Having procured a relay of elephants, I left the town on the 13th, and, crossing by a route to the south of that taken by previous travellers, reached Meh Lyt valley, and ascended the main range to the plateau upon which the Lu-a village of Baw-gyee is situated.

From Baw we descended the hills to Muang Haut, a town on the Meh Ping River, and, hiring boats, arrived at Zimmé on Feb. 23. The scenery on the Meh Ping is very beautiful. Between Zimmé and Muang Haut the river generally hugs and twirls about the spurs to the westward that spring from the haunches of a magnificent round-topped hill called Loi Pah Kung, or the Cloud-Capped Mountain. This hill

SHAN HOUSE AT KIANG HSEN.

dominates the whole range: its summit must be about ten thousand feet above the sea. Another striking feature is the Hill of the Tiger Head, called so from the resemblance the precipice that forms its eastern face bears to its godfather. The banks of the river for many miles below Zimmé are fringed with villages, the houses being embedded and often hidden in gardens of palm, cocoanut, mango, tamarind, orange, and other trees. Farther down stream the villages become less frequent, and are often screened from view by the plume-like bamboos that fringe the banks. The lights and shades on the foliage, and the deep, cave-like recesses between the clumps, together with their elegant and ever varying form, crested at times by the crimson blossoms of the lepan, poukbin and pin-leh-ke-thit trees, gave the whole scene a charm that is passing description.

Leaving Zimmé, we passed for twelve miles through the cultivation and villages lying to the north of it: then, getting amongst the hills lying to the east of the Meh Ping valley, we descended a few days afterwards to Viang Pa Pow, which lies in the valley of the Meh Low, that empties into the Meh Kong or Cambodia River a few miles south of Kiang Hsen. We were now amongst the wizards and witches. The

Pee Ka, or horse-shaped spirits, that I have before alluded to, attach themselves sometimes to one, and at other times to another, of their descendants, who are supposed to have the power of using them as ministers of ill to their neighbors. The belief in these spirits is universal through the Shan state, and is the cause of a vast amount of cruelty and misery. A man falls ill; his malady baffles the skill of the physician; the spirit doctor is called in, and decides that it is a case of witchcraft. The doctor calls the officer of the village and a few others as witnesses. His first question to the invalid is, 'Whose spirit has bewitched you?' If no reply is given, the sick person is pinched, or beaten with a cane, until he makes the disclosure. The replies are put down to the witch-ghost, uttered through the mouth of his victim. Other questions are then asked; such as, 'How many buffaloes has he?' 'How many pigs?' 'How many chickens?' 'How much money?' The answers to these questions are written down by the scribe. A time is then appointed for meeting at the accused person's house. The same questions are put to him as to his possessions. If his answers agree with those of the sick person, he is condemned, and held responsible for the acts of his ghost. He is ordered to leave the village, has his house unroofed and pulled to pieces, and his garden trees cut down. Witches and wizards, who are thus driven with their families from their homes, are only allowed to resettle in certain places: amongst these are Muang Paow, Muang Ngai, Muang Pai, and Kiang Hsen. There was hardly a village of any size through which we passed that had not one or more houses unroofed, the people of the house having been ousted on this fearful charge. The Pa-pow plain is fast being brought under cultivation by these exiles: it is many miles in length, and of considerable breadth.

After leaving the plain, we continued along the route Capt. M'Leod took in 1836, as far as Kiang Hai. Here we had to stay a day or two to procure a relay of elephants. At Kiang Hai we met for the first time Moosurs, called so by the Shans, but La-Hoo by themselves. Their faces were of a decided oval, and their Turki aspect bespeaks them of similar type to the Mohammedans of Yunnan. The high position that is allowed to woman amongst the Indo-Chinese was evidenced throughout my journey. Their power and acknowledged rights are well exemplified by the law of divorce amongst the Moo-sur. These people are monogamists. Either can divorce the other at will, on payment to the divorced party of a sum of forty rupees. The woman takes the house, the daughters, two-thirds of the clothing, one-third of the money, and half of the goods. The sons, together with the remainder of the clothing, money, and goods, go to the man. From Ban Meh Kee, a village of two hundred and thirty houses, near the border, we turned eastward, and, passing the remains of the three ancient cities of Manola, proceeded to Kiang Hsen. The remains of the three cities of Manola, each about half a mile in diameter, consisted of a ditch dug round the bottom of knolls, and heaped up to form high parapets on either side. The top of the inner ramparts are about forty feet above the bottoms of the ditches, which are about a hundred feet wide. During my various journeys, I passed through, or not far from, and learned the names of, forty-eight such deserted cities. As some of these were upwards of two miles in width, the population of the country at one time must have been large. Many of these cities, however, may have been cities of refuge for the people of the districts in time of invasion, and only partly occupied in times of peace. The Kiang Hsen plain is perhaps the largest and most fertile in the Shan states. It extends for fully a hundred and fifty miles from north to south, and is often many miles in breadth. Teak grows luxuriantly upon the low hills in its neighborhood; and in the forests on the eastern side of the Meh Kong, there are said to be extensive tracts covered by it. The city of Kiang Hsen was re-occupied in 1881. Its former wealth and population must have been great; as there were fifty-three monasteries within its walls, and many very valuable bronze images of Buddha are scattered about the enclosure. We met large bodies of emigrants proceeding to Kiang Hsen during our

RUINS AT KIANG HSEN.

journey to Kiang Hai, and heard from the prince of the place that forty-eight hundred fighting men, with their families and slaves, had been told off from Zimmé, Lakhon, Lapoon or Labong, and Peh, to settle in the plain about Kiang Hsen. Most of these are the descendants of the captives who were removed after its surrender in 1797. Returning to Kiang Hai, we followed the Kiang Hsen plain from the basin of the Meh Low into that of the Meh Ing, and reached the town of Penyow, where small-pox was raging. Here we were detained for some days, waiting for elephants. Leaving the town on the 28th of April, we crossed into the valley of the Meh Ngow, and thence into that of the Meh Wung, on which the important town of Lakhon, which contains about ten thousand inhabitants, is situated. Crossing the hills to Lapoon, we arrived at Zimmé on the 20th of April, six days after the commencement of the rains. My companions and all of our servants were suffering from fever towards the latter end of the journey, and I was glad to get them all safely back into Zimmé on the 24th of May. After stopping a week in the town, I left for Bangkok.

THE LAST CRUISE OF THE ALBATROSS.

The U. S. fish-commission steamer Albatross, arrived at Wood's Holl, Mass., July 16, from her first cruise to the important fishing-banks located off the coasts of the maritime provinces, where she had been making extensive investigations in the interests of the cod and halibut fisheries for about a month. Most attention was paid to the region of the Grand bank, south of Newfoundland, including its northern, western, and southern slopes, and the adjacent waters of Green's and St. Peter's banks. Thence the explorations were continued across Banquereau and Misaine bank, and as far to the westward as LeHave bank. On the homeward passage, a few observations were made along the outer slope of George's bank. Over a hundred hauls were made with the beam-trawl and dredge, and much hand-line fishing was done. An attempt was also made to obtain specimens from the bottom by means of torpedoes exploded in a depth of about forty-five fathoms; but without success, only two or three cod and haddock coming to the surface. These experiments clearly proved that only such fish as possess large swim-bladders are likely to float after having been killed at the bottom in this manner.

The results obtained on this cruise are of great value, and an exceedingly large number of specimens serving to explain the character and resources of the fishing-grounds was secured. These explorations are, in fact, the first of the kind that have been made of the outer banks to the eastward of the meridian of Halifax; and they furnish us with the first connected series of observations that has been obtained regarding one of the most important fishing-regions of the world. They are also of especial interest at this time, in view of the probable re-opening of fishery negotiations between the United States and Canada. Almost the only previous information we possessed respecting the fauna of the great banks was secured through the agency of the Gloucester fishermen, whose services to the Fish commission since 1878 have already been made known.

The cruise of the Albatross, just ended, is to be regarded as scarcely more than a preliminary one, since there are many important problems bearing upon the distribution and migrations of food-fishes over the great banks, which invite a prolonged series of careful investigations according to modern methods of research. It was noticed, that, on some portions of the Grand bank, where good fares were being obtained by the fishing-vessels, the bottom was comparatively barren of life; leading to the conclusion, that, over some areas, the fish must feed mainly upon free-swimming animals above the bottom, and that the true value of a fishing-ground cannot always be determined by means of the dredge.

As incidental features of the cruise, careful sounding observations were made at the reported locations of Hope bank, Watson's rock, and the Jesse Ryder rock, without finding any traces of their existence. Many icebergs were observed south of the Newfoundland coast, and foggy weather frequently interfered with operations.

Lieut.-Commander Z. L. Tanner, U.S.N., was in command of the Albatross, with Capt. J. W. Collins in charge of the practical fishery investigations, and Mr. James E. Benedict as chief naturalist, assisted by Mr. Sanderson Smith, Mr. Willard Nye, jun., and Mr. Thomas Lee.

REFORM IN GEOGRAPHICAL ORTHOGRAPHY.

The absence of system in geographical orthography, especially in English maps, and the consequent confusion and variety that exist in the spelling of foreign names on such maps, have necessarily attracted the attention of cartographers of every country. The council of the Royal geographical society has taken the matter up, and proposes what seems to us, on the whole, a very satisfactory set of rules, which will hereafter be used in all the publications of the society. These are in brief as follows: Names of countries in which the Roman alphabet is used will be spelled as by the respective nations. Names familiar in a certain form (ex., Calcutta, Celebes, Mecca) in English literature will be retained unchanged. The true sound of the word, so far as it can be indicated by the system as pronounced by the local population, will be reproduced as the basis of the spelling. In general, the vowels will be pronounced as in Italian, and the consonants as in English. Only one accent, the acute, to denote stress, will be used. Every letter is pronounced. To shorten the vowel, the consonant following it is doubled (ex., duty, putty). The spelling of Hunter's Monumental gazetteer of British India will be followed for Indian names within its limits.

These rules are essentially such as have governed American philologists under the lead of George Gibbs for many years, and, while not equal to the refinements of the lexicographer, are abundant for daily needs. Those who use maps cannot be bothered by minute shades of difference in pronunciation, which can only be properly studied on the spot where they exist.

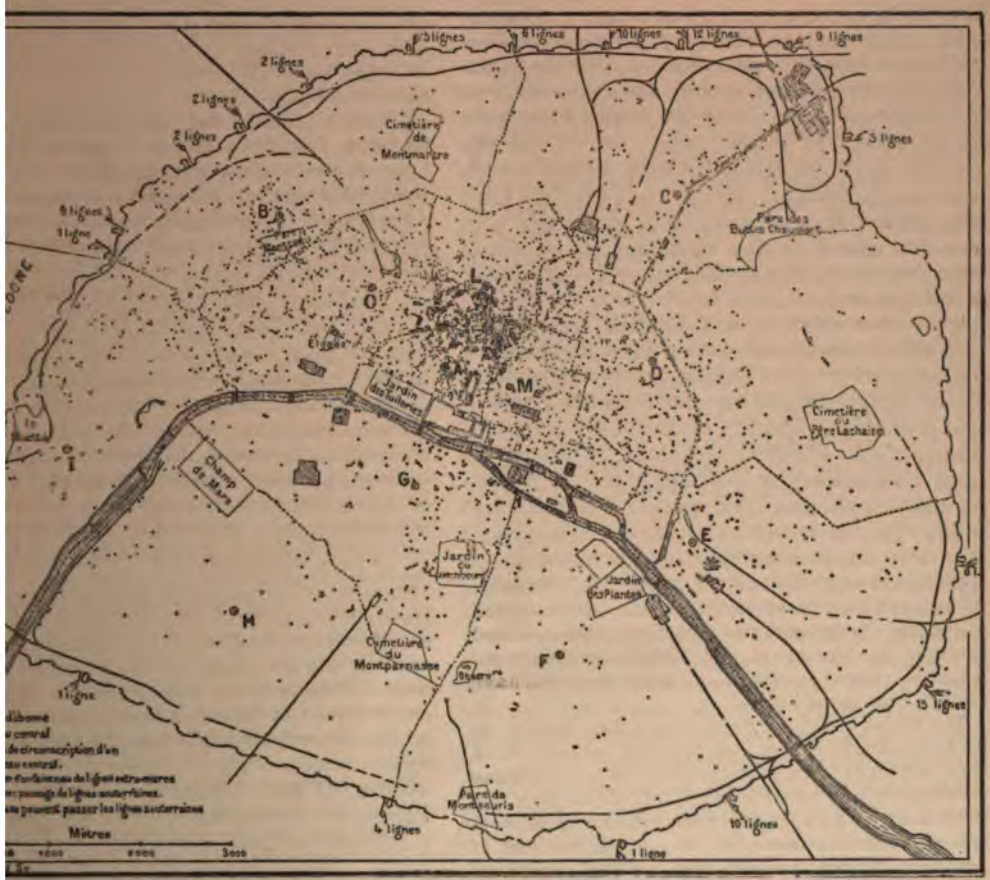
It will be observed that the treatment is far from radical, and eminently practical: the only wonder is, that it has been so long deferred. The time for an international alphabet for map use, whose letters shall have invariable values, which would be the most satisfactory solution, is likely to be long deferred on account of certain obvious though unscientific objections. The proposal now made is in the right direction, and its principles have to a large extent been adopted already on the admiralty charts, and by leading geographers of various nations.

THE TELEPHONE IN PARIS.

We reproduce from *La nature* a map showing the distribution of telephone subscribers in Paris. This map gives all the offices of the subscribers, represent-

s: it shows the central bureaus, A, B, C, D, H, etc., and gives other information as in- the legend.

lephone system of Paris is, after that of one of the most prosperous, numbering at f last April thirty-eight hundred subscrib- unequally distributed over Paris and the as is easily seen from the map which shows tribution Oct. 1, 1884, with the points of nt of the lines outside of the city walls rom each of the gates. In the Opera and



MAP OF PARIS, SHOWING THE DISTRIBUTION OF TELEPHONES (*La nature*).

listricts, the subscribers are most abundant. e a dozen district offices so distributed as to e service with the minimum of conductors; m being, as is known, almost entirely subter- Between each of these twelve offices, and n others, there are auxiliary lines sufficient ish communications between the subscrib- assing through two district offices at the atever be the distance between the subscrib- e number of these auxiliary lines naturally ith that of the subscribers connected with rict office.

PROFESSOR SUMNER'S ECONOMIC ESSAYS.

"ONE may read, in scores of books and articles, that political economy is passing through a transition stage. . . . It is certainly true that there is no body of economists engaged in carrying on the science of political economy by a consistent development of its older results, according to such new light as can be brought to bear upon them. . . . A host of writers have been busy for the last twenty years, introducing conflicting and baseless notions, which, for want of a competent criticism, have won standing in the science. Others have made a boast of turning their backs on scientific method, and of describing, by way of contributing to political economy, some portion of the surface appearance which is presented by

Collected essays in political and social science. By WILLIAM GRAHAM SUMNER. New York, *Holt*, 1885.

the mass of economic phenomena in their sequence, variety, and complexity. That is as if a historian should boast of abandoning the attempt to trace social forces in history, and of returning to the description of royal marriages and diplomatic intrigues."

Professor Sumner thus describes, in the opening sentences of the second essay in the volume before us, the present condition of economic science. That such a description should be in the main a true one is deplorable; and Professor Sumner is deserving of all commendation for his stanch loyalty to well-established economic doctrines, and to the cause of scientific method as against empiricism in economic research. But if the world has been going astray in recent years, we do not believe it has been solely because we are a stiff-necked generation. Much has doubtless been due to the sins of the time; but much, too, can be traced to the shortcomings of those who maintain the true doctrine. Probably nothing has done more to discredit the authority of economists of the English school than the wide-spread opinion that they decide every question of political economy, however complicated, by an offhand application of a few simple principles. And it does indeed belong to the intrinsic character of their investigations that a few leading principles are kept constantly in view, and that questions which would otherwise be involved in hopeless confusion are thus made amenable to orderly and systematic and frequently successful treatment. Too many writers, not without standing and authority, not without learning and penetration, have, however, gone farther, and fallen into the way of cutting the knot of every intricate problem by a single sharp and decisive blow of the sword, — by an appeal to the magical force of a great economic law. They have thus given the objectors to the science of Ricardo and Mill a real and important ground for their criticisms.

Unfortunately, Professor Sumner too often places himself in the ranks of the writers we have just been describing. In the volume before us there are three economic essays, — on bimetallism, on wages, and on the argument against protective taxes. In the first and third, there is before the writer a distinct fallacy to refute, a distinct outrage upon economic doctrine to resent; and it is in such a situation that there is the strongest tendency to crush an opponent by a single blow, to sweep away all argument by a single appeal to an all-comprehending principle. Accordingly, we find that Professor Sumner's argument against the possibility of a concurrent circulation of gold and silver may be summed up in the mere *dictum*, that, since supply and demand regulate value, all the governments in the world could not make silver and gold circulate together; and his argument against the belief that protective taxes may in some cases contribute to the general prosperity is little more than the bald statement that restraints upon commerce introduce no new productive power, and hence cannot increase the aggregate production, while, as every tax and every restraint involves waste and loss, there is sure to be a diminution in the aggregate production, and a fall in the general prosperity.

Considerations such as these are very good as far as they go, and are indeed of the highest importance. They give a *prima-facie* reason for believing that those who expect economic advantage to arise from protection, or who think it possible to make gold and silver circulate side by side as prime mediums of exchange, are mistaken. One may say more: it needs but a brief and clear exposition of general principles to take the ground from under the feet of all the ordinary advocates, on the stump or in the newspapers, of protective taxes or bimetallic currency; or, rather, to show that such advocates, ignorant of the first principles of political economy, and heedless of the simplest requirements of sound reasoning, had no ground to stand upon. But there are men who know something about political economy, and still think that an agreement of all the commercial nations of the world could keep silver circulating alongside of gold at a constant ratio: they have heard of supply and demand, and have some understanding of its working; they know, as well as Professor Sumner does, that congress cannot, that all the governments of the earth cannot, enforce a fiat that a pound of meat shall have the same value as a pound of sugar; they know also, however, that the demand for the precious metals comes in a very great measure from their use as coins, and that their use as coins is in a great measure affected by the more or less arbitrary action of governments. It behooves an economist, under these circumstances, to point out, if he can, that the influence of governmental action upon the demand for gold and silver has such bounds, that variations in the supply might occur — or must occur — sufficient to overbalance that influence. Professor Sumner contents himself with repeating, in every variety of expression, the assertion that government cannot confer upon any thing a higher value than that which is determined by demand and supply.

"Congress cannot regulate the value of money until it can make a man give for a gold dollar one grain of wheat more than supply and demand force him to give, or yield a gold dollar for one grain less than supply and demand will give him for it. . . . It cannot regulate the value of a coin, any more than it can regulate a physical object to make it longer or shorter than it is. . . . To secure a concurrent circulation, then, at a fixed ratio, it is necessary to suppress the effects, which can only be done by suppressing the forces; so that a concurrent circulation could never be realized until we could extinguish economic forces by human agency." Now, all this might be well enough by way of reply to one who was ignorant of the existence of 'economic forces' and the rest; but of what avail is it as against a man whose mind is troubled by the fact that governmental action is itself, in the matter of currency, one of the most constant and apparently important of these 'economic forces'? Intelligent doubters and honest opponents can be but little influenced by the levelling of economic anathemas at them: they can only be won over by a fair statement of the strongest arguments that can be urged on the other side, and a refutation of them.

Similar objections apply with equal force to Professor Sumner's treatment of the subject of protection. It is of immense advantage to correct thinking on the subject, that one should see, first of all, clearly and unmistakably, that a protective tariff is a tax on production; that its immediate effect is to diminish production, to reduce the returns to labor and capital, to lessen the rewards of human effort. The demonstration of this important though simple truth at once clears the air of the mists and vapors with which it may have been filled by popular ignorance and misconception. But when it is urged by clear and candid thinkers that there may be cases in which, even upon purely economic grounds, it may be worth while to incur this loss for the sake of a future gain made possible by it, it is useless to dogmatically shut off discussion by simply saying that protection is an economic loss, and nothing but economic loss can come of it. There is not the least disregard of the principles of political economy in supposing that an industry which it would not pay to introduce in a given country, without government protection, might be a profitable and independent one after it was introduced. Lack of knowledge, national habits, the prestige of foreign manufacturers, — such are some of the causes which may prevent the rise in a given country of an industry for the pursuit of which its natural advantages may be exceptionally great; and it is simply impossible to 'demonstrate' that an industry may not thus be established a century sooner than it would otherwise be, and which, in all but its first years, would be a source of increased prosperity to all classes of the people. There are a thousand valid objections to protection even in this case, but it is not an economic absurdity. To say, as Professor Sumner does, that "it is mathematically impossible that it [a protective tariff] should ever issue in an independent and productive industry," is to vastly diminish, in the mind of an intelligent reader, the force of those conclusions whose truth has really been demonstrated.

Ungracious as it may seem, we have yet to draw attention to a special feature in the style and method of Professor Sumner's argument which is calculated to intensify the impression of dogmatism and reckless generalization which economic writing of this character so often produces. This is his constant employment of language borrowed from mechanics or physics, and especially his frequent appeals to the principle of the conservation of energy. Amateurs in natural science have shown, in the last decade or two, a very great fondness for this principle, and have delighted in exhibiting the facility with which, by its aid, they could solve the problem of the universe, or any smaller problem which might happen to engage their attention. But responsible writers on political economy — or, for that matter, on any other subject — will do well to leave the principle of the conservation of energy to play its proper part in its proper field. Some writers might be surprised to find how necessary it is even in that field, to use it in the exact sense in which it is understood by mathematical physicists; how little it enables one to do easy, offhand work, and accomplish the immediate despatch of all scientific business. One regrets to see even so much as the *term* used in discussions that are outside the domain of physics, for fear that the vagueness which must necessarily there attach to the term may affect the reasoning in which it appears; this, however, may in some sense be regarded as a matter of taste. But to use the principle of the conservation of energy by way of *argument* in economic discussion is utterly unjustifiable; and when a writer says that "to suppose the contrary" of an economic proposition, "is to deny the most obvious application of the conservation of energy to economic forces," he can but make the judicious grieve. The acme,

however, of this kind of writing and thinking, is reached by Professor Sumner, when, in one of the non-economical articles (p. 134), he gravely tells us, speaking of elections, that "they are not a source of energy, and therefore cannot cause any thing at all."

We have dwelt thus at length upon these faults, because we consider them as most hurtful to the cause of sound discussion, and to the influence of the very methods in political economy which, with Professor Sumner, we wish to see upheld. We have not attempted to give a full account, or, if one prefers the expression, a fair account, of the papers collected in this volume. In the article on wages, and even in those on bimetallism and on protection, there are instructive passages and telling points. The articles are not made up entirely of impatient assertion and sweeping denunciation. In the discussion of bimetallism, valid practical reasons are adduced against it, and the same is true with regard to protection; but it is precisely the theoretical core of the argument which is made weak and powerless by the defects which we have endeavored to point out.

SCIENTIFIC CULTURE.

The question of the position of the physical sciences in courses of instruction, as compared to that of the classics, was scarcely thought of at the time when Professor Cooke began his work as an instructor in the experimental sciences thirty years ago. During this long service as a teacher and investigator, the question became a glowing one, but has been so far settled as to give to many of the essays of the little volume before us an historical rather than a current interest.

Nevertheless, the general reader who may care nothing for the Greek question will read these essays with pleasure. He will admire the earnestness and candor of the writer. He will follow with delight the limpid stream of argument and exposition. To the citation drawn from the literature of physics, to the effect that "such men as Davy, Dalton, and Faraday were as truly learned, as highly cultivated, and as capable of expressing their thoughts in appropriate language as the most eminent of their literary compeers," might be added the name of the author.

The most important statements which are made in these essays are quite independent of the subject-title. They should be printed after the manner of certain biblical texts, and displayed on the walls of every collegiate hall in the land.

We append a few of these paragraphs: —

"There is no nobler service than the life of a true teacher; but the mere taskmaster has no right to the teacher's name, and can never attain the teacher's reward" (p. 85).

"The teaching which a professorship implies, instead of being a hindrance, ought to be a great stimulus, to scientific investigation. Of course, this influence is greatly impaired, if, as in many of our colleges, the available energies of the teacher are exhausted by the daily routine of instruction, or by outside work required to supplement his meagre salary; but if the teaching is only moderate in amount, and in the direction of the professor's own work, there is no stimulus so great as that which the association with a class of earnest students supplies" (p. 280).

"Men of affairs should resign the endowments intended for the maintenance of scholars to those whose zeal is sufficient to induce them to make gladly the sacrifices which the advancement of knowledge usually entails" (p. 277).

Scientific culture and other essays. By Josiah Parsons Cooke, LL.D., professor of chemistry and mineralogy in Harvard college. Second edition, with additions. New York, *D. Appleton & Co.*, 1885.

AROUND AFRICA.

The activity which the Germans have shown during the past few years in colonial and commercial enterprises has produced some good results, and has given occasion for a few good books, notably those of Schweinfurth and Nachtigal. Dr. Joest, instead of following those explorers into equatorial Africa, circumnavigated the Dark Continent, visiting only a few inland towns in the extreme south-east. He described his travels in a series of letters to the Cologne *Zeitung*, which form the basis of the present work. Schweinfurth and Nachtigal performed their tasks well, and gave us good common-sense accounts of the people they visited, and the countries they saw. So has Dr. Joest. His first stopping-places were Madeira and St. Helena, which have been so often described that he was able to add little of interest. From St. Helena he went to Capetown, or Kapstadt, as he in true German fashion insists upon calling it. And this is a good place to utter a protest against the habit which the Germans have of translating proper names; for, really, 'Kapstadt,' 'Tafelbai,' and 'Kapland' do not represent the places described. Indeed, either this fact seems to have struck

Um Afrika. Von Wilhelm Joest. Mit 14 lichtdrucken und zahlreichen illustrationen. Köln, 1885. 8°.

hor, or a longer sojourn among Eng-aking people (he was obliged to trav-st entirely on English steamers) may ade the English words less displeasing ; for further on he writes of Port Eliza-nd Steamer Point without any com-ns. From Port Elizabeth he travelled to Kimberly, and Orange Free State, g the coast again at East London; to Port Natal, where he again left the nd proceeded to Durban and Zululand. tes Zulu, Zambesi, and Zanzibar, 'Su-ambesi,' and 'Sansibar,' on the ground epresents the sound better than *z*. So, spells Cetewayo, 'Ketschwayo,' and making such allowances, his account of the English South-African colonies is sufficiently full and accurate for the general reader.

The illustrations are a feature of the work. But while the full-page *lichtdrucken* ('heliotypes') are excellent, a few smaller portraits of negro men and women have much more interest for the student of African ethnology. Indeed, Africa should be visited by a good photographer, — one who would be willing to devote a portion of his energies to taking pictures of individuals, and not, as has generally been the case, confine himself to groups of badly scared natives artistically arranged in rather suspicious-looking 'market-places,' 'main streets,'

NATAL CAFFRE.

SULU MAIDEN.

ly is right in all four cases. Returning t Natal, he once more took steamer, fter touching at ten or eleven places, re-home *via* Aden and the Suez Canal. ited neither Angra Pequena nor any ort on the coast now claimed by Ger-in south-western Africa, nor Madagas-ncerning which there is need of fresh liable information. With these excep-he did all that could be expected of nd we know of no better account of the , economic conditions, and ethnographic s of the countries visited. Some allow-f course, must be made for his sympa-h the boers as against England; but, and the like. The volume is further illustrated by a very good map — as maps of Africa go — from the establishment of Justus Perthes, showing our author's route, and the portions of the coast-line claimed by the English, French, Spaniards, Portuguese, and Germans. One noticeable feature is that the Welle of Schweinfurth is given as probably identical with Stanley's Aruwimi, which would seem to be a rather premature statement. Then, too, the courses of rivers are laid down altogether too positively. Still, one should not quarrel with this map on that account, as it is a failing of nearly all maps of Africa, and, indeed, of maps of all partially explored countries.

...says are to be found ... *centralblatt*, and the ... 1885. The latter is ... advantage of being ... admirable popular article. As the new Darwin memorial has recalled ... of evolution against ... to think how opportune ... the fossil link, Archaeopteryx, ... reptiles, came to support the Darwinians, ... a storm of discussion, and there was no ... excitation in Germany when the specimen ... was said to leave Solenhofen for the British museum. It was sold for thirty-five hundred dollars to the British. Altogether Archaeopteryx has probably excited more human emotions than any other fossil. The second specimen of Archaeopteryx was more perfect, and was finally sold to the Berlin museum for twenty thousand marks. This specimen has been recently described by Professor Dames, the first having been monographed by the celebrated Richard Owen. Wiedersheim does not accept Dames's conclusions, but gives at the end of a recent article his own views as to the evolution of birds. He thinks the class had a double origin, ... two divergent lines from some as yet undiscovered reptilian ancestor. One line led through the saurians to the ancestor of Marsh's Hesperornis and the running-birds (Ratitae); the other began with long-tailed saurians, from which ... on the one hand, the flying saurians; on the other the line of development leading to Archaeopteryx, and further, to Marsh's Ichthyornis, the ancestor of the flying birds (Carinatae). Whether this theory of the double origin of birds will hold, may be questioned; but, at the same time, the theory cannot be summarily dismissed. It does not yet appear that the theory will satisfactorily account for the ornithic characteristics of the two great classes of birds, since the divergence, it supposes, began between reptilian ancestors.

— In consequence of prolonged researches on the absorption and assimilation of peptone, Dr. F. Hofmeister has arrived at some very interesting results. When peptone and other nutrients are introduced directly into the blood, even in small quantities, they are excreted through the secreting organs, whilst on the contrary, if much larger quantities of the same substances enter by way of the intestine, under physiological conditions, nothing similar is observed. From these phenomena, Hofmeister concludes that the absorption of peptone in the intestine is no simple mechanical process of filtration or diffusion, but a function of the epithelial cells, — the colorless blood-corpuscles. Foreign substances are no doubt carried about in the circulating fluid; and whether they are absorbed by the tissues, or lost, depends upon chance alone. ... so in the case of 'cellular transportation:' ... the substances are enclosed in the cell-walls. ... are not subject to the laws of diffusion, and are ... used up until they reach the tissues which have an affinity for them. If the cells are moved about by the currents in the blood, they reach the tissues by

chance; but, if they have an automatic motion, they are in a degree independent of the air-current, and can direct their own course. The amoeboid movements of the cells may have some connection with the presence of an excess of nutrient matters for distribution.

— Herr Hilt of the Prussian fire-damp commission says, as the outcome of a long series of practical experiments on the very fine coal-dust of Pluto mine in Westphalia, that "there can be no doubt, that, with this kind of dust, the flame could be lengthened out to any desired length, provided the gallery and layer of dust on its floor were made equally long." Differences in chemical composition do not appear to have so much effect in controlling the length of flame produced by a given dust as the comparative fineness of the particles. The French commission finally pronounced that coal-dust is an element of very secondary importance; but the Prussian commission, partly from the large scale upon which it worked, and partly from the natural fineness of the dust upon which it experimented, has arrived at the opposite conclusion. One of the most violent explosions on record recently occurred in the Camphausen colliery; and it is generally admitted that coal-dust, not fire-damp, was the principal cause of destruction.

— It is generally admitted that the most effective arrangement of a course of instruction in qualitative analysis includes a brief study of the more important compounds of the elements composing the group, as regards their solubility, followed by a method of analysis, this plan being applicable both to basic and acid analysis. The acids may be classified with nearly the same precision as the bases, so that the presence or absence of a group containing half a dozen acids can be shown by means of a single reagent. The 'Treatise on practical chemistry and qualitative inorganic analysis,' by Frank Clowes (Philadelphia, *Lea brothers & Co.*, 1885), follows the above plan in general, except in the arrangement of the acids. It adheres to the use of tables, which may be regarded of questionable utility unless the student is required to prepare them for himself. The selection of reliable tests and methods is, for the most part, all that could be desired. Much useful information is given concerning laboratory arrangements, apparatus, preparation-work, and chemical operations in general, which will doubtless be serviceable to many teachers, especially the hints on laboratory construction, and the directions for preparing reagents and substances for analysis. In fact, from its scope and general arrangement, the work seems better adapted for the use of teachers and advanced students than for an introductory text-book on qualitative analysis.

— In *Symon's meteorological magazine* (April, 1885) the old idea of having a floating mid-Atlantic meteorological observatory is once more urged. As most of the changes in British weather are due to the passage of storms from the west to the east, the only practicable way of forecasting these storms is by some such station, in about latitude 50° north, and longitude 20° west. The depth of the water at this point is about two thousand fathoms (two miles and a quarter); and a mooring-chain of that length would be a decided novelty, but not an impossibility, for the cable-laying steamship Faraday once found herself in the course of a cyclone which passed by without causing her to loose her hold of the cable. To lessen the expense, which might otherwise interfere with the project, the vessel could also be used as a call-station for passing vessels and for those in distress.

— We reproduce from *Science et nature* a picture of the statue of Claude Bernard, the eminent French physiologist, which has just been erected before the Collége de France. It was executed by Guillaume of

the French institute, and, on the occasion of its unveiling, was accompanied by a eulogy by Béclard, the dean of the faculty of medicine of Paris, a portion of which is reproduced in *Science et nature* of June 6.

— N. de Miklouho-Maclay tells us (*Proc. Linn. soc. N. S. Wales*, ix. 963), that during the years 1871 and 1872 no less than thirteen earthquake shocks were felt on the Maclay coast of New Guinea. Upon his return to that region in 1876, the mountain peaks which in 1872 were covered with vegetation were in places quite denuded, and portions of the coast devastated by tidal waves. There were crevices from one to three feet wide, and three or four feet deep; and the depth of the sea was in some places appreciably altered. Since 1876 there have been only slight shocks, which have occurred at the same time as

eruptions in the various volcanoes on the island. In addition to the slight changes accompanying the frequent earthquakes, there are evidences of a recent extensive rising of the whole coast. In hills of a greenish sandy clay, there are layers of the remains of marine animals now inhabiting the shallow waters. These layers are at various heights, from one hundred to four hundred feet above sea-level. Another proof that the coast is still rising is the existence of numerous reefs of dead corals, which are left quite dry at each low tide.

— Dr. J. J. Weyrauch of Stuttgart has published (Leipzig, *Teubner*) a lecture on the history of the conservation of energy, which he delivered at Stuttgart in March of this year. In a series of appendices he has brought together a large number of references to the literature of the subject.

— The British steamship Venetian, Capt. Traut, reports that on July 16, in 43° 08′ north, 51° 25′ west, they sighted a very large iceberg two hundred feet out of water, five hundred feet long, and four hundred feet wide. As it was very clear at the time, and the vessel to windward of the berg (wind moderate from the southward), Capt. Traut experimented with the thermometer, to see if the ice had any influence on the temperature of the water. To his surprise, he found that there was no appreciable difference, the thermometer standing at about 57° for several miles on either side of the berg and close to it. He steamed alongside the berg, about eight hundred feet from it, and still the temperature remained the same.

— Miss Alice Lamb, a student of Professor Holden's at the Washburn observatory, publishes in the July number of the *Sidereal messenger* a critical discussion of the Willets Point latitude observations, which appear to show a decrease in the latitude of that place during the last five years. By selecting the best-determined stars, and by rejecting the observations with one of the instruments, and the work of some observers whose probable errors are about twice as large as the probable errors of those whose work is retained, she concludes that "there is perhaps strong reason to attribute the systematic change of latitude" to errors of observation, as Gen. Abbot has suggested.

— According to a paper read by Herr Mohr before the Magdeburg district association of the society of German engineers, the deepest bore-hole in existence is that bored for coal, near the village of Schladebach, on the railway between Corbetha and Leipzig. The total depth of this bore-hole, which has been driven with a hollow diamond-pointed rock-drill and water flushing, is 4,559 feet. Its diameter at the bottom is 1.872 inches, and at the surface 11 inches. Boring operations have been carried on for three years and a half, and a sum of $25,000 has been spent in reaching the depth attained. The temperature in the lower portion of the bore-hole was found to be 48° C., equal to 118.4° F.

— In Lord Aberdare's address at the annual meeting of the Royal geographical society of London already referred to, he stated that the continuous prosecution of marine surveys in different quarters of the globe had been well maintained during the past year. The two home surveying vessels have been employed, one on the west, and the other on the east, coast of Great Britain. On foreign surveys, sixty officers and five hundred men have been employed in four steamships of war and five other smaller vessels. These ships have been at work in Newfoundland, the Bahama Islands, Magellan Straits, South Africa, Red Sea, Malay Peninsula, coasts of China and Corea, north-west coast of Australia, and amongst the Pacific Islands. The most important additions to our hydrographical knowledge are as follows: The survey of the Little Bahama Bank will be shortly finished, and the same may be said of the southern shore of Newfoundland. The survey of the main strait of Magellan, to which reference was made in the last address, was completed early in the year. Many useful additions have been made to ports and salient parts of the coast of south-east Africa. In the Red Sea the intricate approaches to Suakin have been well laid down. On the west coast of the Malay Peninsula, Penang harbor has been resurveyed, and the positions of the islands lying to the north-west, and forming the eastern boundary of the ordinary route of vessels to Malacca Strait, have been accurately determined. The unknown western shores of Korea, south of the approach to Söul, for two degrees of latitude, have been explored, and the main features of this island-studded shore laid down. New rivers and harbors have been entered, notably the large river Yun-san-gang, at the entrance to which stands the considerable town of Mokfo. There appears, however, to be little chance of immediate trade with Korea, in consequence of the absence of any valuable products, and the scanty needs of the population. The southern approach to Haitan Strait on the Chinese coast, much used by British trade, has been recharted. On the difficult shores of western Australia such progress has been made as the small means at the disposal of the surveyors has permitted. In the Solomon Islands the Bougainville Strait has been charted. This channel will in future be most probably a highway for traffic between eastern Australia and Japan. Many additions have also been made to the charts of various groups of other Pacific islands. The survey of the coasts of India, carried on by officers of the Royal navy and India marine, has been actively progressing. Surveys of Rangoon, Cheduba, and other ports in the Bay of Bengal, as well as harbors on the west coast of Hindustan, have been made. A resurvey of the great Canadian lakes has been commenced in Georgian Bay.

— In Beloochistan, there are days when the air is so filled with sandy dust that the sun is obscured, and the particles of sand penetrate every thing. This is especially the case when there is no wind. The whirlwinds of sand are also common in this region. During a calm day, when not a breath of wind is felt, one can notice these columns rise and grow, and, beginning to rotate, travel forward across the country. They often attain considerable velocity, then decrease

ppear. Sometimes several may be seen at t time, each having a separate origin. The call them shaitans, or devils. Another very phenomenon in the same region is the sand- hich often occurs after several calm days, e air is very warm and oppressive. The ws violently, sweeping the sand across the Lightning and thunder and rain form a part torm, which often lasts several hours, then aving the air pure and clear. During the onths the very hot and destructive wind e simoom sweeps across the desert, destroying able life, and often killing men by its scorch- th. This wind is comparable with the sirocco editerranean, though much more destructive.

interesting account of Erythroxylon coca, istory in Peru and in Europe, will be found ll pamphlet by Dr. Sigm. Freud ('Ueber coca,' 885, 26 p., 8°), together with an account of n on animals and on a healthy man, and its tic uses. He makes the noteworthy remark, ile in North America preparations of coca dy much used, in Europe they are scarcely o the majority of physicians, even by name. test use of coca will probably always be that he Peruvians have made of it for hundreds ; viz., to enable them to bear arduous physi- ion for a short time without food or rest, as n travelling, in the ascent of mountains, etc. e purposes it seems to be preferable to al- It has also been tried in digestive troubles, otidote for morphine habit, and as a substi- alcohol, as well as for other purposes.

e *Botanical gazette* for July devotes a large its space to the subject of bacteriology, in- notes, comments, and book-reviews. It is a he right direction; for only by the publication er of this kind, and the increase of interest l follow, can the study of bacteria be brought roper level in this country. This branch of ation is constantly and rapidly growing in im- , and any attempt to diffuse a knowledge of going on among its students deserves the t commendation.

a lecture delivered in the Khedival institute , Dr. G. Schweinfurth has given some ac- the seats of manufacture of prehistoric stone nts in the desert of eastern Egypt, discovered In 1876, 1877, and again visited and exam- him in his last journey. The two spots to are in the Wadi Sanur and Wadi Warag. ner lies due east of Beni Suef, at a distance r miles from that town. The latter is in the ortion of the Wadi, at the place where the urse begins to be discernible as a longitudi- ession on the heights of the western part of Galala. Dr. Schweinfurth's belief that the in question are really those of ancient man- s of stone implements is grounded partly presence of accumulations of cores in the the streams, partly on the fact that the raw is found abundantly in the neighborhood. The source of the raw material is a bed of flints belonging to the upper nummulitic limestone corresponding to that which exists behind Cairo. Implements and utensils indicating a stone period have now, Dr. Schweinfurth remarks, been found, even in the very heart of Africa; and these show a surprising resemblance in form to those discovered in Europe. Those recently obtained by himself from Sanur and Warag, however, are of a special type; and Dr. Schweinfurth regards them as clearly distinguished from the forms already familiar, by the fact that the facets are usually only upon one side, and are very seldom seen surrounding the entire core.

— From a report of Mr. H. Walker, commissioner of lands of British North Borneo, it appears that gold exists in considerable quantities in that territory. Some natives had brought a little to Sandakan, and Mr. Walker set out to verify its existence in the Sagama district. He searched thirty or forty different places, and found gold at almost every place, generally in small specks, large enough to be gathered with the fingers, sometimes larger, and always in conjunction with a black metallic dust and iron or copper pyrites. The rocks met with were granite, gneiss, quartz, limestone, jasper, porphyries, and red sandstone. Steps will probably be taken to have the whole region thoroughly examined by a competent geologist. The minerals already ascertained to exist in North Borneo are gold, silver, copper, chromium, tin, plumbago, lead, and coal. Antimony and cinnabar are reported. On the west coast, chromium, copper, and arsenic have been found; in the neighborhood of Kinabala, silver ore and pyrites. A sample of native copper has been sent to London. A rich sample of galena and silver, yielding on assay a hundred and fifteen ounces of silver to the ton, has been found. A good deal of information still rests on the rough statements of natives, but British North Borneo is undoubtedly rich in mineral as well as agricultural wealth.

— Professor Karl Gottsche of the University of Kiel, has just returned from his travels in eastern Asia. After having lectured on mineralogy and geology for several years at Tokio, he undertook a scientific exploring expedition in Korea, at the request of the Korean government, which lasted until December, 1884. His route extended over three thousand kilometres. Dr. Gottsche intends shortly to publish his geological, mineralogical, and ethnographical investigations of Korea.

— Professor Huxley is, it is understood, going to retire from the various posts he holds under the English government, on a pension of twelve hundred pounds a year.

— The Berlin society for the advancement of manufacture has offered a prize of fifteen hundred marks for the best essay on the progress, present position, and capability of application, of the photo-mechanic process for the reproduction of drawings, woodcuts, copperplates, oil-paintings, and photographic representations of nature, with a comparative review of its results.

— The commission appointed by the Belgian government to experiment on Pasteur's method of protecting cattle and sheep from anthrax by inoculation with the attenuated virus have published their report. They find, from very numerous vaccinations which have been performed at Hervé since the spring of 1883, on farms where anthrax breaks out every year, that Pasteur's method preserves both sheep and cattle from the disease. No case of anthrax has been observed among a thousand fully-grown cattle which have been vaccinated, while the non-vaccinated have died, as usual. As regards the duration of the protective influence, it has been found to be one year for young animals in the proportion of ninety per cent, and at least two years for all mature animals. They confirm Mr. Pasteur's statement that places where animals which have died of anthrax have been buried are dangerous, the soil retaining the germs.

— The Austrian central tourist club has addressed a petition to the assemblies of all Austrian alpine provinces to pass a law prohibiting the wholesale uprooting of edelweiss now carried on. The petitioners point out that hundreds of thousands of the plants are dug up, and sent abroad, even to America; so that there is a fear that the favorite plant of all lovers of the Alps will be exterminated, except in a few remote places. Several Swiss cantons have passed such a law.

— Professor Milne has been engaged in researches on the oscillations of sea-level in the Kurile Islands. He finds that the two islands Iturup and Kunashiri form the first two of the series of stepping-stones which connect Japan by means of Kamtchatka with Asia. They contain a greater proportion of rounded hills and of deeply cut valleys than any of the islands farther north, and may therefore be regarded as older than those which are built up almost entirely of finely formed volcanic cones. The neighboring island of Urup presents appearances similar to these two. The formation of an island like Iturup probably commenced as a number of volcanic peaks forming islands, which were subsequently elevated, of which there are indications in the stratified rocks and terrace formations. All the appearances, however, which Professor Milne has ascribed to a raising of the land, might, he observes, be also explained by raising and lowering of the sea, such as that which Mr. Croll argues might be produced by the accumulation of ice at the pole; and the fact that the height of the terraces increases northwards appears to confirm this view.

— Mr. J. Macdonald Cameron has printed a report on the bituminous deposits of the Camamie basin of the province of Bahia in Brazil. In addition to the purely commercial portion of the report, there is much interesting information with regard to the various descriptions of these oleaginous deposits. Mr. Cameron has some interesting remarks on the influence of the mangrove on the muddy swamps on the coast. The dirty grayish black mud in which the mangrove vegetation is very luxuriant, resembles that noticeable in England in rivers and streams on the banks of which oil or soap works are s
He inclines to the opinion that this mud is pri
formed by the continuous decomposition of t
and branches of the mangrove trees. Th
currents ebb and flow slowly, and hence
sweep away the mud. Thus abundant food
tree is insured "as well as a store of ole
material for the use of distant generations of
beings."

— The articles of scientific interest in the
general magazine for July are as follows: Gr
len has an article 'Concerning clover' in the
man's magazine, — a very interesting account
various kinds of clover, the object of the d
modes of flowering, and the general points o
est concerning the plant. The science note
same magazine, conducted by W. Mattieu W
contain a few remarks upon the recent s
events of popular interest. In *Longman's ma*
Grant Allen is also the scientific writer of the
His article entitled 'The first potter,' is a *ré*
our knowledge of prehistoric pottery. Und
title of 'Recent progress in biology,' in the
teenth century, Ray Lankester takes up, in a
rate manner, all the recent steps of progress
science, laying most stress upon Koch's and
well's investigations. The article in the same
zine, entitled 'Transylvanian superstition,' by
Gerard, is a very complete enumeration of t
number of superstitions of this very super
country, which cannot fail to be of great i
to anthropologists. An article in Blackwood's
burgh magazine on 'Footprints,' proves th
human footprints often found on the rocks in
countries are artificial, and the remnants of th
system of the aborigines. The *National revi*
an article upon 'Some higher aspects of mesm
by E. Gurney and F. W. H. Myers. The ti
plains itself, and it is interesting to find the s
so well treated in a general magazine. In th
temporary review, G. J. Romanes publishes hi
lecture for 1885, — a long dissertation on the r
between 'Mind and motion.' Under the t
'Dangers of medical specialism,' H. B. Donki
an opposite view from that entertained by
Mackenzie in a recent article, and urges that s
ism in medicine should not be made a trade.

Among the American magazines, there a
really good popular scientific articles. In the
lic world, there is a very popular article of so
entific interest, entitled 'Among insects in a so
city,' by T. F. Gabney. The *Andover revie*
tains an article by Rev. E. M. Bliss, upon 'Ku
and the Kurds,' which is a very good descrip
the people and the country. The article in the
American review upon the 'Subterranean his
man,' by S. C. Bartlett, is a rehash of the
obtained by the recent investigators of this s
'Mohammedans in India,' by F. Marion Cra
in Harper's, possesses some scientific interest.
Century has an article on the 'Gate of India,'
map, and one upon 'Frank Hatton in North B
by his father, with notes from the explorer's di

SCIENCE.

FRIDAY, AUGUST 14, 1885.

ICIAL SCRUTINY OF THE U.S. COAST-SURVEY.

ous charges have been brought by the ities in Washington against the adminis- of the U.S. coast-survey. During lays past, the newspapers, under more sensational headings, have given cur- o statements and insinuations of a dam- character. Some of the articles which ome under our eye are obviously wrong, contain half-truths, and some are in- with animosity toward particular men, ard the prosecution of purely scientific

Up to the time when these lines are n, we have seen nothing in the jour- hich bears the stamp of official accu- but there appeared on Friday last what rts to be a summary of the results at- by a committee of investigation ap- d by the treasury department. If so is to be said in public, as is contained in tatement, we regret that the charges are thenticated by a signature, and that the stances under which the inquiry has conducted are not clearly made known. redit of an important branch of the pub- rvice, as well as the personal standing leading officers, is involved in these ations. A decent regard for justice, and consideration for those who have long ained a good report, require something han anonymous and semi-official commu- ns, sent out by telegraph, in which it is ossible to discriminate the pen of the er from that of the authorized investi- and in which it is still harder to deter- what are the charges of the complainants, hat are the conclusions of the tribunal. reticence should govern an investiga- ntil some conclusion is reached which e openly made known, or else there be sufficient publicity in the conduct of the inquiry to acquaint the public with the extenuating circumstances of the defence, and the answers which are made to the preferred complaints. Unless we are misled by these unofficial statements, it appears that the superintendent of the survey has been deposed from his office for alleged mismanagement, that the assistant in charge at Washington has been first removed and then restored, and that several persons employed by the survey (chiefly in subordinate relations to the service) have been brought under censure.

We have no disposition to apologize for, or to screen, continued neglect of duty, or abuse of the high responsibilities which are attached to the conduct of an important post; but certain facts of an explanatory character should certainly accompany expressions of blame. The friends of the superintendent are aware that he has been for a long while a sufferer from a painful disease. He has been advised, as we are informed, to seek relief from acute and distressing attacks by the use of agents which are extra hazardous. There is no doubt that his efficiency as an administrative officer has thus been seriously impaired. It would have been well, under circumstances of so much responsibility, if he could have been quietly retired in view of the long-continued, efficient, and able services which he has rendered to the country. Failure resulting from physical infirmity, and from the employment, however injudicious, of the prescribed means of relief, is failure still, so far as the conduct of a public office is concerned; but it is not the failure of a dissipated man indulging in vice. The accused is not to be condemned like one who has surrounded himself with bad associates, or who has appropriated to his personal gratification the public money. His previous record of fidelity, application, and uprightness should be remembered. A sharp distinction should be drawn between erroneous methods of control which

— The commission app
ernment to experiment o
feeding cattle and sheep
with the attenuated vi
port. They find, fro
which have been pe
of 1883, on farms wh
year, that Pasteur's
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observed among a
have been vaccina
died, as usual. A
tive influence, i
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are dangerous.

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rtheless, all this scientific research is ated by a very small number of persons. , the more valuable it is, the less obvi- y be its merits. Every seaman knows ıe of a good chart: not every seaman, ry scholar, not every statesman, knows ditions by which a good chart is pro-

It is only the expert who appreciates tle sources of error which must be elimi- he only knows the infinitude of mathe- , physical, astronomical, and geodetic ns, which are involved in an endeavor to faithfully such a coast line as that of the States, and to keep the portrayal in ac- correspondence with the changing sands. judge of what to do, and how to do it, e the superintendent. Congress must w much money may be spent, and the ry of the treasury must exercise an ty over the methods of expenditure: master of the works must be the head survey; and, although he is liable to like the general in the field, or the sea- n the deep, the ultimate results, attained his guidance, are the criterion of his fic efficiency.

the zeal for civil-service reform, which haracterized the new administration, it ot be surprising if outlays for scientific ation, experiment, and research should arded as questionable if not extravagant. ot to be wondered at, that an auditor of ts should consider as needless, expendi- which experience has shown to be abso- necessary for the efficient management cientific bureau. It will not be strange ommission of government officials pro- s many of the investigations of the coast- to be incomplete, useless, or unduly . It will be easy to gain a reputation nomy, and for discovering the faults of ing administrations, by striking at work, thods of which, from their very nature, omprehensible to the public. It is easy ish witticisms to innumerable writers dicious repetition of scientific technical- But, happily, Congress is not likely to led by such combined misapprehensions and misrepresentations. The president, unless we mis-read his official and personal character, will insist upon wise economy. Beyond the administration and Congress, there lies an appeal to the intelligence of the people, who certainly do not want parsimony in the study of the sea-coast. Honesty and accountability will be demanded by the public in all branches of the government service: they will rejoice in every check which may be devised to prevent the misappropriation of funds, but they will not want the efficiency of the coast-survey impaired. An administration will indeed appear awry, which proposes in one breath to restore the navy to efficiency, and in another to interfere with the accurate study of the coast, and with the perfection of our knowledge of harbors and reefs. Let there be fair play in considering the affairs of the coast-survey, and we shall have no fears of the result.

LETTERS TO THE EDITOR.

A mad stone.

THE Sedalia and other papers lately contained accounts of the application of a 'mad stone' to a Mr. Girard of this city, who had been bitten by a supposed mad dog.

The stone was owned by Mr. J. M. Dickson of Kansas City, who advertises the use of the stone, and states that it has been in possession of his family for more than a hundred years, and was brought by one of the family from Scotland. From the large number of references given in Mr. Dickson's advertisement to the mayor and other officials, and physicians of Kansas City, we may take it as true that Mr. Dickson is honest in his belief as to the virtues and history of the stone.

To a reporter Mr. Dickson made a statement that he had applied the stone to more than five hundred cases of bites by various kinds of mad animals and wild skunks; his opinion evidently being, that the bite of this animal, whether rabid or not, will produce hydrophobia. He gave the method of application, which was to place the stone upon the wound, or upon an abrasion of the skin made on any part of the body, first soaking the stone in sweet milk. He stated, that, if the person contained any virus, the stone would adhere to the wound or abrasion until it was saturated with the poison, when it would fall off; and that it was then cleaned by again soaking it in sweet milk, and this was repeated until the stone would no longer adhere.

We may presume, that, of the five hundred treated by him, a large number had been bitten by animals which were not mad; and statistics show, that, of those bitten by dogs which are mad, not more than one-third to one-half will have hydrophobia; and yet we can hardly suppose, that, of five hundred persons who believed themselves to be in danger of hydrophobia, not one would have taken it even if no preventive measures had been taken. Mr. Dickson

states, that no case treated by him has developed into hydrophobia.

At the time of Mr. Dickson's visit to Sedalia, I had the opportunity of seeing the stone for a few minutes, and found it to be a fossil coral of the genus Favosites. It was of rather small size, only about three-fourths of an inch across, and was of hemispherical shape, with one side cut so as to present a smooth surface. The fossil seemed to be silicified, a part of the tubes being filled almost to the ends, and a part open. The tube cavities on the flat surface generally presented open spaces between the diaphragms or tabulae, making the stone more or less cellular or porous. From the slight examination I made of the stone, I judge it to be Favosites gothlandica Lam., if from Scotland; and, if it is American, F. hemisphericus Y. and S.

I have since seen Mr. Girard; and I learn from him, and also from the Sedalia agent of the Adams express company, that the stone was first soaked in sweet milk without having any effect upon the color of the milk. It was then applied to the arm, and adhered so tightly, that, on turning the arm over and shaking it, the stone still clung to it. About three times the stone was taken from the arm and soaked in milk, and it then turned the milk a greenish color. At last the stone would no longer adhere to the wound, and the cure was pronounced complete.

Has any competent person made proper tests of reputed mad stones? Are these persons mistaken about the stone adhering tightly? Would any similar porous stone adhere the same way? Are the persons also mistaken about the change in the color of the milk? In short, will any stone have any effect on virus in a person's blood? F. A. Sampson.

Sedalia, Mo., July, 1885.

[We may add as a final query, How did such a superstition arise? — Ed.]

The inscription rocks on the island of Monhegan.

During a recent visit to the island of Monhegan, Me., my attention was called by Mr. P. C. Manning of Portland to the so-called inscriptions described and figured by Schoolcraft in his 'Indian tribes,' vol. vi. p. 610. The inscriptions are on a small island, Menana, which is separated from Monhegan island proper by a narrow channel. The principal inscription, that figured by Schoolcraft, is on the nearly vertical face of a small cliff about five feet high, situated a few rods north and east from the fog-signal station. The country rock of both islands is a black or dark-gray rock different from any rock I have seen in Maine except at one other locality. A lithological description of this rock is reserved for the present. It shows great numbers of veins. Part of these veins are of white granite, or sometimes of white quartz; but many are black, like the surrounding rock, and differ from it simply in fineness of grain. When weathered, even the blackest of the rocks become dark gray in color. As the various layers differ so much in granular condition, and somewhat in composition, they naturally weather and fracture very differently. Some of the rock is quite massive, with no regular fracture: other layers fracture quite prismatically, almost like slates. The rocks are everywhere weathered into forms unusually varied, and often fantastic; the veins sometimes weathering faster than the contiguous rock into furrows, at other times into ridges. The joints and veins are often arranged systematically.

When one first sees the inscription rock, he cannot fail to notice that the appearance is as if a tablet had been prepared upon the surface of the rock, no zontally, but obliquely. There are two paralle rows about one-half an inch deep, and eight apart; and the so-called letters are on this 't The tablet has a fine-pitted surface of weat quite even and flat. The surrounding rock is coarsely pitted. Examination shows that this ent tablet is simply the exposed edge of a fine-g vein which penetrates the coarser-grained ro liquely. This vein shows both on top of the ro also on the side. The parallel furrows which e the so-called inscription tablet are simply furr weathering at the sides of the vein. The su letters are composed of straight furrows inters each other obliquely, so that most of them are modification of the letters V and X. A cross-s of these furrows ends in a sharp angle enclos tween curved lines, like the sinus of a crenat At the base of the furrows I invariably found a in the rock, though sometimes not readily witho aid of a magnifier. There are two systems of joints, — one nearly vertical, the other nearly a angles to the sides of the vein. Nearly all th rows forming the supposed inscription belong to two systems of joints: a few are aberrant, an are horizontal. Most of the joints are filled v film of oxide of iron, but the two horizontal and two others are open. At the point whe vein obliquely enters the rock, the furrows o vertical wall are continued without a break a the angle of the rock to the edge of the roof-exp of the vein. This is plainly caused by the same penetrating the vein at both exposures. In ge the exposure of the vein on top of the cliff has more unevenly eroded, and shows fewer furrow small piece has recently been broken from the s east corner of the inscription tablet; and an filled crack, which is found at the base of a f above this fracture, can be seen crossing the surface, though it is faint. The inscription fu bend downward into the two longitudinal fu which border the so-called inscription tablet. surrounding coarse-grained rock shows but fe rows, and they are not so regular in outline as on the edge of the vein.

It is evident that the 'inscription' is a freak o face erosion. The furrows are the result of we ing along joints. At the same time they differ the ordinary weathering of the island in certain d

A few rods from this inscription is a smaller very much like it in form of erosion furrows; found a small slab, near the north-east angle of hegan island, showing almost identical V and X f

Portland, July 27. G. H. Sto

Recent contributions to the literature micro-biology.

Two works upon this subject have recently published. Dr. Friedländer, pathologist to Fried hain, has reviewed the French work of Corni Babes mercilessly, and with a personal animus harmony with scientific accuracy. It will be re bered, that Dr. Babes was the Hungarian auth who bitterly opposed Koch's views of the tuber bacillus, and sought to substitute in lieu th 'Babes' granules.' He was, for a short time, a st in the laboratory of Professor v. Recklenhausen then went to Dr. Cornil, in Paris. Later, he ca Prof. Dr. Virchow, in Berlin, where he has rem ever since. He is still a very young man; and wh has not the extended experience in pathologica cology of Friedländer, Koch, or Hirschberg, h been constant, in season and out of season, in hi

vestigations, and may justly claim a voice in
l department. It is to be regretted, that Dr.
icedes the primary discovery of the specific
different morbid processes to Babes alone.
nous' creeps into the various chapters with
cy not in harmony with accepted facts. So
nown to microscopists, Dr. Babes has made
l discoveries; and the work is valuable for
only (and in this particular its worth may
restimated), and as a fresh proof of Professor
acility as a writer. Lustgarten has priority
covery of the contagium vivum of syphilis,
in the peculiar process of staining. I saw
ke several ineffectual attempts to carry out
n's directions, even while his book was
ough the press; so that his statements in
ection, as well as those that occur in the
of actinomycosis, are purely imaginative.
coses have been successfully colored by only
in Berlin, but his name was not Babes.
vings in some cases are pretty good. The
vings are, however, wretched, and convey
ly erroneous impression of the growth of
Cornil's work in the book is without spot or
and it is unfortunate that his duties as min-
ublic instruction did not allow him to give
ntion to the details. Drs. G. Sims Wood-
Arthur W. Hare, have brought out a book
Pathological mycology'). Dr. Woodhead
Berlin for a few weeks, worked in the labora-
d then returned to Scotland, and wrote a
he nature and scientific value of this publi-
ay be estimated from the length of time
s given to the study of micro-biology. The
n of methods is entirely out of date. The
ons are singularly inaccurate, notably No.
ll of the potato-drawings. No. 22 is not
Koch at all, and in No. 34 the tubes are not
erly. No. 37, with description, is absolutely
It is evidently a *contaminated*, and not a
ture. There is no detailed account of *drop*
of plate culture, which is the very basis of
ethod of pure culture. The bacillus of blue
ms a *brown* tint, and not a '*green*' tint, as
ors claim.
r of these works finds great favor among
men in Germany, and neither conveys any
impression of the exact processes of inquiry
to a comprehensive, intelligent survey of
ology. Even Koch himself stands but yet
threshold, working his way into the clear
ruth through much tribulation and scepti-
d even he would never dare to pronounce
h autocracy upon certain processes, as do
ose enthusiasm leads them to snap judgments
w weeks of special study.
eresting matter lately happened in Professor
laboratory at Dresden. A friend of mine,
up the micro-organisms of different earths,
ecimen from underneath the laboratory win-
rom this he cultivated some specimens of the
anthrax. Inquiry showed that formerly this
been used as a burial spot for sheep dying
ax, but that for *ten* years it has not been used
a purpose. HORATIO R. BIGELOW, M.D.
chs. Schweiz, July 13.

correspondent makes some strong statements
ed modification. The animus of Friedländ-
ism of Cornil and Babes' book (*Fortschritte
cin*, July 1, 1885) may be easily understood,
value by so much. So far as our perusal
bacteries' has informed us, the 'L'un de
oken of in our letter, refers purely to *con-firmatory* work done by one or the other of the authors, and is not a claim to originality. To our thinking, Lustgarten, being the only one mentioned at all in connection with syphilis in the classification of the schizomycetes, receives all the credit the most grasping could desire: and the fact that Babes failed once or twice to stain the bacilli, proves nothing in regard to his success at other times (as any practical worker knows); nor, so far as we can see, has it any bearing upon his assertions in regard to actinomycosis. In regard to the staining of the fungus of the latter, we would suggest that some others than the one successful worker in Berlin should try washing the sections for a short time in dilute hydrochloric acid, and then stain according to Gram's method. We fancy there will be no difficulty in finding the fungus stained blue, as was demonstrated in Washington last April. Our review (*Science*, July 24) gives our own opinion of the work. Of Sims and Woodhead's 'Pathological mycology,' we have received only the first part as yet; and we have therefore not spoken of it in detail. Bad as our correspondent seems to think it, it promises to be at least the best work upon the subject that has yet appeared in English. — ED.]

'Color associations.'

Another curious phase of color association, besides the interesting one mentioned by Dr. C. S. Minot, is that in connection with names.

I have heard three children of different temperaments in the same family avow an association of colors with names. Strangely enough, they agreed on nearly every example; as, for instance, that Kate was red; Mary, white; Alice, violet; Dick, deep Vandyke brown; William, a watery blue, etc. This seems even more arbitrary and unaccountable than color associations with months; as that might, to some extent, be influenced by the prevailing tints of natural objects at those particular seasons. Thus the tone of sunlight during January, February, and March, determining the color associated, shining white yellow; that of the April sky, when there is otherwise an absence of striking color; the leading hue of Mayflowers; the zenith of verdure in June, — all may assist in forming the color associations. I may add, I know the use of color-symbols for names to exist also in adult minds in a less definite degree (the agreement between different persons also not so unanimous), but quite sufficiently to cause a confusion in recalling names of the 'same color;' as, for example, Martha and Mary Ann, both being classified as 'brownish drab.' I think if this connection of ideas were traced to the root, it would result in the conclusion that the assortment is conducted on a very elementary basis; as in the case of the two last-mentioned names, usually belonging to persons engaged in ordinary work-a-day pursuits, they are represented, or rather produce an identical effect of commonplace neutrality upon the mind, with the tint commonly adapted to serviceable uses. It is probable that thought is much more frequently carried on by hieroglyphics of form and color than by words. In fact, these afford too slow a presentation of ideas, while some faintly defined symbol conveys the effect of whole sentences at an instant. As Ribot explains a certain illusion of memory: 'there is a ground of resemblance quickly perceived between the two impressions, which leads us to identify them.' We confuse similar modifications of the nerve elements as the pictures on two slides passing simultaneously through the magic lantern are combined.

K. A. CHIPMAN.

6 Place d'Armes Square, Montreal, Aug. 3.

IMMORTALITY IN MODERN THOUGHT.

It will be admitted, we think, that the tendency of modern science is materialistic. This is especially true of biology. In fact, to many the doctrine of correlation of vital with physical forces, and the doctrine of derivative origin of species, seem little short of a demonstration of materialism. Thus materialism has become a fashion of thought; but, like all fashions, it has run into excess, which must be followed by reaction. We believe the reaction has already commenced. Science sees now, more clearly than ever before, its own limits. It acknowledges its impotence to bridge the chasm between the physical and the psychical. We pass from physical to chemical, and from chemical to vital, without break. All is motion, and nothing more; also, in the region of the vital, we pass from sense-impression through nerve-thrill to brain-changes, and still we find only motions. But when, just here, there emerge consciousness, thought, will, the relation of these to brain-changes is just as unimaginable as the appearance of the genie when Aladdin's lamp is rubbed.

It is impossible to emphasize this point too strongly. Suppose a living brain be exposed to an observer with infinitely perfect senses. Such an observer would see, could see, only molecular movements. But the subject knows nothing of all this. His experiences are of a totally different order: viz., consciousness, thought, etc. Viewed from the *outside*, there is nothing but motions; viewed from the *inside*, nothing but thought, etc., — from the one side, only material phenomena; from the other, only psychical phenomena. May we not generalize this fact? May we not extend it to nature also? From the *outside* we find nothing but motion. On the *inside* there must be consciousness, thought,[1] etc.: in a word, God. To bridge this chasm, whether in nature or in the brain, Science is impotent. As to what is on the other side of material phenomena, she is *agnostic*, but cannot be materialistic.

Admitting, then, in man a world of phenomena, which cannot be construed in terms of motion, and which for convenience we group under the name of 'spirit,' is the group permanent? Is the spirit immortal? On this subject, Science can say absolutely nothing. The field is therefore open for evidence from any quarter, and of any degree. Some of these evidences, though not given by Science, are at least suggested by lines of scientific thought. A few of these we briefly mention.

1. We have said that consciousness and thought lie behind material phenomena, in nature and in the human brain. In the one case we call it God, the divine Spirit; in the other, the spirit of man. Now, does not this identity, or similarity of relation to material phenomena, imply, or at least suggest, *similarity of nature*, and therefore immortality for the spirit of man?

2. Individual human life passes through its little cycle of changes, and quickly closes in death. If this be all, then *for the individual*, when all is done, it is precisely as if he had never been. "Yes," answers the Comtist. "for the individual, but not for humanity. Every human life leaves a residuum which enters into the life and growth of humanity. It is a glorious and unselfish religion thus to merge one's self into the only true object of worship, — humanity." But, alas! the cycle of humanity also closes; and for humanity too, when all is done, it will be precisely as if it had never been. 'But the earth — the cosmos — abides.' Yes, but only a little longer. Science declares that the cycle of the cosmos must also close. And then, when all is done, after all this process of evolution reaching upward to find its completion in man, after all the yearnings, hopes, struggles, and triumphs of man, what is the outcome? It is precisely as if the cosmos had never been. It is all literally "a tale told by an idiot, full of sound and fury, signifying nothing." Not only heart, but reason, revolts against such a final outcome. If we believe that reason underlies the phenomena of the cosmos, we cannot accept such a result. We cannot believe that the cosmos has no intelligible end. But what intelligible end is there conceivable, unless something is finally attained which is not involved in a cycle, i.e., unless man is immortal?

3. There are three primary divisions of our psychical nature; viz., sense, intellect, and will. There are three corresponding processes in making a complete rational philosophy: viz., (1) instreaming of impressions of the external world through the senses (facts); (2) elaboration of these into a consistent whole by the intellect (knowledge); (3) outgoing of this knowledge in activity (conduct). Now, a true working theory of life must satisfy all these. But scientific men are apt to think that only (1) and (2) are necessary; that true facts elaborated into consistent theory is all we need care for. Theologians, on the contrary, seem to

[1] This thought is admirably presented by Johnstone Stoney, *Nature*, vol. xxxi. p. 422.

think only (2) and (3) necessary: they elaborate a theory of life consistent with itself, and apparently satisfactory in its application to conduct, but are less careful to test its harmony with facts derived from the senses. But all three are necessary.[1] The first furnishes material; the second constructs the building; the third tests its suitableness for human habitation. All admit that successful application to art is the best test of true theory. But conduct is the art corresponding to our theory of life, and therefore the *test of its truth*. Now, is not immortality as an element of our theory of life in the highest degree conducive of right conduct? Is it not a useful, yea a necessary, element in a working hypothesis?

4. But it may be objected, animals, too, have brains: in them, too, we find evidences of something like consciousness and thought. Are they, too, immortal? If so, where shall we stop? We pass down by sliding scale, without break, to the lowest verge of life. Shall we stop here? No: for vital is transmutable into physical forces. Thus all is immortal, or none. Thus hope of immortality vanishes, as it were, by evaporation.

This objection, though serious, is, we think, not fatal. To make our view clear, we use an illustration taken from biology. May we not imagine that in animals spirit is in embryo in the womb of Nature, unconscious of self, and incapable of independent life; and that in man it came to birth, — a separate spirit, — individual, conscious of self, and capable of independent life, on a new and higher plane? According to this view, geological time is the period of gestation, evolution is the process of development, and the appearance of man the act of birth.[2] JOSEPH LE CONTE.

THE BRITISH MUSEUM OF NATURAL HISTORY.

THE visitor to the west end of London is confronted, upon turning into Cromwell Road, by a large and majestic building, whose architectural grace and warm color make a very pleasing impression upon the eye. This recent addition to the splendors of the West End is the home of the natural-history departments of the British museum. By its completion the plans of certain prominent English naturalists are happily consummated. As early as 1854 Dr. Edward Gray, alarmed by the rapid growth of the national collection of objects from the three kingdoms of nature, memorialized the trustees of the British museum upon the necessity of better accommodations. In 1862 the matter received careful attention from Professor (now Sir) Richard Owen, who published an elaborate essay upon the proper scope of a national natural-history museum, in which he presented plans for the division of material, and the erection of a museum building. These and other plans were thoroughly discussed by the naturalists of England, and the critics became eventually divided into two opposing factions, — the one maintaining that it was best to hold the natural-history collections in Great Russell Street by an enlargement of the original edifice; and the other, that it was more desirable to erect a new building somewhere in the western part of the metropolis, where more air and a better light could be obtained. The latter view finally prevailed in the government councils; but, by reason of a combination of unfortunate circumstances, nothing was done toward the erection of a new building for nearly twenty years. The collections were not moved from Great Russell Street until the autumn of 1880.

The new building stands upon a part of the ground allotted to the great industrial exhibition of 1851. Near it are the South Kensington and Indian museums, and the structures occupied by transient displays, such as the recent fisheries and hygienic exhibitions. The main portion of the building faces Cromwell Road, and presents a frontage of about six hundred and fifty feet. The two central towers are flanked on either side by a long wing and a terminal pavilion. The wings are three stories high, with a basement. The style of architecture is Norman-Gothic, richly ornamented with animal forms and conventional figures drawn from animate objects. At the back of the principal part of the structure are a number of single-storied annexes, running out at right angles to the main wall. Light for the rooms at the front and sides is obtained through large windows reaching down to the floor, but the annexes are lighted from the top.

The entire building is constructed of a buff-colored terra-cotta, which, as already intimated, is elaborately modelled, especially about the windows and doorways. The walls of the interior are likewise ornamented with conventional figures in relief. The ceiling of the central hall, presently to be mentioned, is inlaid with wooden panels upon which are painted representations of different species of plants in life-colors. The floor is a rich marble mosaic.

[1] Reflex action and theism. WILLIAM JAMES. *Unitarian review* for November, 1881.
[2] *Princeton review* for November, 1878.

The main entrance leads into the great central hall, a hundred and fifty feet long, ninety-seven feet wide, and about sixty feet high, lighted by windows near the roof, and having a gallery on the sides at the level of the second story, reached by a grand staircase at the back. The ground-floor of this hall is occupied by the index collection, which is lodged in twelve arched alcoves on the east and west sides. It also gives room to a great sperm-whale skeleton, which is the first specimen one sees upon entering the building.

Back of the central hall is another somewhat smaller, — ninety-seven feet by seventy feet, — which will be devoted to the collection illustrative of the British fauna.

On the west side of the central hall is the entrance to the bird gallery, which occupies the entire first story of the west wing and terminal pavilion. The wing is two hundred and thirty-three feet long and fifty feet wide; the pavilion, sixty feet by forty feet. The east wing and pavilion, which are of like proportions, are occupied by the fossil mammalia. Between the back wall of the wings and the annexes previously mentioned is a long narrow corridor lighted from above. The western corridor is occupied by coelenterates and sponges, and the eastern by fossil reptiles. Each of the annexes is occupied by a single group. The most westerly room contains mollusks, after which follow echinoderms, reptiles, crustaceans, and fishes. The annexes at the east of the central hall contain fossil fishes and various groups of fossil invertebrates. It will be perceived that the eastern half of the first story is devoted to fossil animals, while the western half is occupied by a portion of the collection of recent animals. The second story of the west wing is given up to mammals, and that of the east wing to minerals. In the third story (which is reached by a bridge) the west hall contains the collection of mammalian osteology, and the east hall the plants.

The basements are principally devoted to work-rooms and storage-rooms for duplicates and supplies; but at the extreme western end a cetacean gallery has been established, in which the entire collection of whale skeletons has been brought together.

There is one commodious apartment on the ground-floor which deserves special mention. It is designated as the students' room. Persons who have obtained permission to study in the museum can have brought into this room such specimens as they wish to examine. Tables and other conveniences are provided, so that investigations can be carried on with a very considerable degree of comfort. This system must commend itself to the officers of all large public museums, and to the students who resort to them.

It is manifestly impossible, within the limits of this article, to describe the cases used in the museum, or the modes of arranging specimens. Suffice it to say that the former are elaborate and costly, and appear to have been designed with much care, and that the latter are in most cases not only highly instructive, but artistic.

The chief excellence of the new structure lies in the series of annexes or galleries lighted from the top, and devoted to single groups of forms. This arrangement is in some sort an extension of the system of alcoves employed in numerous museums, but is greatly superior to the latter, on account of the size of the rooms and their complete isolation.

It is perhaps ungracious, where so much is admirable, to call attention to features which have the semblance of defects. Nevertheless, the building has been severely criticised by English naturalists, both on account of its architectural elaborateness and the faulty arrangement of its parts. The arrangement of the staircases is such as to occasion much unnecessary walking; and there is no way by which to move large specimens from the lower to the upper stories. The light in the alcoves of the central hall, devoted to the index collection, is insufficient, while along the entire southern façade it is admitted in such excess as to surely prove ruinous to the mounted specimens in the cases between the windows. There is no regular provision for a library.

It should be remembered, however, that no perfect structure was ever erected, and that the defects of this building are lost sight of in its general excellence. Its superiority over the old quarters at Great Russell Street is so great as to make comparison impossible.

The museum in Cromwell Road has somewhat more than a third more available floor-space than our national museum at Washington; but the capacity of the latter can be greatly increased by the addition of galleries. We are here comparing, however, a *part* of the British national museum with the whole of our own; for while the building at South Kensington is intended to contain only animals, plants, and minerals, the museum at Washington holds all the collections of the government illustrative of the three kingdoms of nature, and in addition those representing the history of the progress of culture and the arts.

After much agitation, the control of natural-history collections has

hands of the principal librarian of the British museum to the newly appointed superintendent, who is styled director. The names of the keepers of the several sections are so well known as scarcely to need repetition. The staff, as now constituted, is as follows: —

Prof. W. H. Flower, director; Dr. Albert Günther, keeper of zoölogy; Arthur G. Butler, Esq., assistant keeper of zoölogy; Dr. H. Woodward, keeper of geology; R. Etheridge, Esq., assistant keeper of geology; L. Fletcher, Esq., keeper of mineralogy; W. Carruthers, keeper of botany. Frederick W. True.

VEGETABLE MORPHOLOGY A CENTURY AGO. — Goethe.

In a previous article we have seen the conclusions reached in matters morphological by Linné and his contemporaries. Thirty years from the time of Wolff and Linné had passed away, when the appearance of Goethe's treatise on metamorphosis gave to the world once for all the true solution of Nature's problem, and, as becomes more and more apparent, determined for the nineteenth century the trend of its scientific thought. Goethe approached and stated the whole question anew; worked it out in his own persistent way; set forth with clearness the truths dimly hinted by Linné, by Wolff vainly declared; and by the splendor of his genius, and his attainments in matters purely literary, compelled the recognition of the world.

Goethe's discovery was a wonder to men of his day, is a wonder still. It is thought that the truth came to him by strange intuition, by special inspiration of some mysterious sort. His mind so surpassed that of ordinary men of talent that to his clear vision nought but truth appeared; as to a Newton, the propositions of simple geometry came without necessity of proof. But such was by no means Goethe's experience. Surely his imaginative genius suggested the idea involved; but the exposition of his theory came after months of laborious investigation, and observations repeated again and again. Furthermore, while the result proves that he made a most 'scientific use' of his imagination, it is also apparent that the poetic use of that faculty is never quite absent from his work. If his testing by observation the suggestions of his imagination is scientific, his fondness for generalization, his instinctive conviction of the unity of natural forms, and many of the details of his theory, are poetic in the extreme.

Goethe wrote of metamorphosis. The term 'morphology' does not appear in his writings until 1807. He uses the former word, however, to denote, not the actual conversion of any one organ into any other, but simply the correspondence of all organs discussed to one and the same ideal type.

In setting forth his theory, Goethe begins with the cotyledons, and shows them to be leaves after their fashion, differing in form from the ordinary leaf of the plant as they differ in function. He also notices that the first true leaves put forth are likewise not perfect, but are usually much narrower and simpler every way than those that follow. Goethe believes that the varying form of the leaf is due to variable nourishment. He regards the sap which nourishes these early leaves as very crude and poor indeed. He observes that the successive nodes of the stem receive each its sap through the medium of those below, and so each receives and furnishes to leaf and bud purer and more refined juices. Further, while the more imperfect fluids are constantly discarded, the purer are as continually assimilated and used, until Nature reaches her prescribed limits of growth: the leaves attain their greatest extent and perfection in development, and all is prepared for a new phenomenon.

Linné had shown that abundant bloom comes from scant nourishment. Goethe reasserts this, and argues, that, so long as raw material is to be disposed of, so long must all possible organs of the plant be converted into tools for the purpose. If too much nourishment is provided, the condition of blooming becomes impossible. Withdraw the nutrition, the organs of the node become more refined; the elaboration of juices unadulterated, purer and more refined takes place; the metamorphosis of the parts becomes possible, and forthwith ensues. When, in the light of present knowledge, we reflect upon the cost at which any plant puts forth its bloom, these century-old surmises of the poet seem to acquire new meaning and most peculiar interest.

In Goethe's time the involucre of a composite flower was still regarded as calyx, and accordingly the gradation from bracts to sepals was easy enough. This mistake does not, however, vitiate the poet's argument on this point; for he asserts the same transition in other plants, and cites the Compositae simply as affording the most patent illustration. He argues with perfect clearness, that the assembling about one point of several leaves, nay, even of several nodes, is not strange, as the same thing may be met in every plumule. The

these narrowed sepal-leaves in the alous calyx is induced by the highly ap circulating in a part of the plant so remote. "In the calyx, Nature pro- thing new. She simply unites and parts already familiar, and so rises by nearer her destination."

as the calyx owes its character to the nts of organs preceding it, so it in omes an organ of filtration; and from vded vessels of the sepal comes the uid which makes possible the petal. petals indicate that the nourishing s reached a high degree of refinement, f absolute purity. The equivalency and petal is shown by the usual com- Goethe adding only that as the sepal contraction, so does the petal expan- d we are thus prepared for the last of contraction in the formation of the The foliar nature of the latter organ, carpels, is shown in the familiar way. aloid style of the iris is cited, as also ersion so common among crowfoots, tc.

t is to the nectary (a very comprehen- m in Goethe's time) that the poet here ief attention. Nectaries seem to occu- termediate place between stamens and ow partaking of the character of one ow of the other. Goethe inclines to ion that nectaries are undeveloped sta- He is certain, at least, that the nectar concerned in the fertilization of the for, "after fertilization, the nectar dis- , and no more is formed." He con- that the nectar might be an imperfect g fluid; that the pollen-grains are so inute vesicles containing an exceeding- ate matter elaborated by the vessels of nen, and destined to be absorbed by the

of all this in view of the modern doc- fertilization and cross-fertilization, and gin to appreciate the inventive genius man, hovering about his subject, and divining that which he could not clearly l then his conclusion: "The forms of about us are not originally determined ariably fixed, but unite with some per- of generic, specific, and individual er, a fortunate power to vary and to odate themselves to circumstances, so able to meet and adapt themselves to ying conditions which come upon the Darwin might have written it: Dar- ld have said no more.

is a brief outline of Goethe's contribu- tion to botanical science. The importance of his discovery can scarce be over-estimated, while its beauty can be appreciated only after careful examination, not only of the discovery itself, but likewise of the manner of its attainment. As to the latter, we are happily not left in doubt. The poet has himself given us a concise account of every step of his progress. We may see the impassioned enthusiasm of Linné stimulating society universal, so that Goethe says it fairly 'floated him along.' What an era in which to live, — the very springtime of science, the air redolent of odors of the life to be! Even petulant, passionate Rousseau forgets for the nonce his dreams of social compact, and, charmed with the beauty of the living world, becomes botanist, and even begins a botanical dictionary. The spirit of investigation was abroad, and Goethe entered his morphological studies with all the energy of his nature. His ideas took possession of him. The voice of Nature cried: he could not choose but hear. His work became a passion, a *leidenschaft* he calls it, from which even the marbles of Italy and the palaces of the 'eternal city' could not divert him. He was a poet; but he suddenly found out that Nature, too, is poetic, and that even her most gifted child has nothing that he has not received, nor has so much that he may not crave and receive the more. The facts of Nature were before him: his thought responded to the thought in Nature. It seemed as if it were so. It must be so. It was so.

It is said that each individual lives in epitome the life-history of his race. May it not be said that in this brief sketch of the rise of a single scientific doctrine we have found those agencies which make possible all and every science, — the light of the eye, the light of the intellect, and the vivid brilliancy of the imagination, — Linné, Wolff, Goethe, — the systematist, the student, and the poet?

T. H. McBride.

AN ATTEMPT TO PHOTOGRAPH THE SOLAR CORONA WITHOUT AN ECLIPSE.

Since writing my last communication on this subject, I have made a series of investigations with the object of improving my apparatus, if possible, and of obtaining some quantitative measurements of the light reflected by the atmosphere near the sun. To avoid the reflection of the light from the surfaces of the glass, I removed my achromatic lens, and substituted for it a simple spectacle-glass of one and three-eighths inches diameter, and forty-nine inches focus. As the diameter was relatively so small, the

attempt to photograph distant mountains. It will be found that it is perfectly impossible, even in the clearest weather, to photograph at a much greater distance than fifty or sixty miles. I recently, on a very clear morning, made a mountain ascent with a camera. Mountains over ninety miles distant were readily recognised and distinguished; but, on pointing the camera in their direction, nothing over forty miles distant could be photographed. There was no question but that mountains at a much greater distance than ninety miles could have been seen, had there been any high enough to be visible. Every photographer who has visited mountain regions is perfectly aware of the disabilities under which he labors in this respect.

Another illustration of the same thing is the impossibility of photographing the moon in the daytime, when the sun is high above the horizon. Although the moon may be perfectly distinct to the eye, the negative shows no trace of it. This fact of itself, I think, has a direct bearing on the question in point.

But in addition to these general facts it was thought that some quantitative results would be desirable. Besides the chloride plates which I had been using, several well-known kinds of bromide plates were tested at the same time. These were selected with especial regard to the strong contrasts qualities which they were supposed to possess. The plates tested were the Anthony chloride, the Carbutt B, the Allen and Rowell, and the Stanley. Different portions of the plate were exposed to a uniform illumination for various times, and it was found that all the plates gave about the same result, and that if the division lines between the areas were very sharp, and over an inch in length, as small a contrast as five per cent could be detected; but if the division lines were not over one-eighth of an inch in length, even if one knew just where to look for them, it was impossible to recognize a difference of less than ten per cent upon the negative. As the coronal rays on the photograph would be less than one-eighth of an inch in length in order to reach out beyond 3', ten per cent was selected as the limit of contrast necessary to obtain a satisfactory result.

Since the light reflected by the corona at 3' distance from the sun is only .1 that of the full moon, in order to distinguish between a coronal ray and a neighboring rift at that distance, it is necessary that the light reflected from the earth's atmosphere in that region should not exceed in intrinsic brilliancy that reflected by the moon itself.

A series of observations was next made to determine the relative light of the sun and of the sky in its immediate vicinity. The method employed was as follows: Half of the photographic plate was covered with thick yellow paper; a diaphragm of .016 centimeter in diameter was placed in front of the lens, and four different exposures made to the sun on different parts of the plate, lasting respectively for two, four, eight, and sixteen seconds. The plate was then taken into the dark room, and the exposed portion protected by the yellow paper, which was re-

moved from the other half of the plate. The telescope was now so placed that the sun should be hidden behind a paper disk, fixed at about twenty feet distant. A diaphragm of one centimeter aperture was placed in front of the lens, and an exposure of four seconds given to the sky. On development, half of the plate, except where cut by the image of the disk, was found uniformly darkened. On the other half were four images of the sun, two of which were lighter, and one darker, than the sky. The third image of eight seconds exposure was of exactly the same darkness as the sky; and it was accordingly shown, that since the diaphragm used with the sky was about four thousand times larger, the sun was about two thousand times as bright, photographically, as the sky in its immediate vicinity. A number of plates were taken on different days, when the sky seemed perfectly clear, and the results indicated that the number varied in general between a thousand and four thousand. Owing to the diffraction produced by the small diaphragm used in photographing the sun, which rendered the image 1.6 times larger than it really should be, all these figures must be multiplied by 1.6.

Comparisons were then made in a similar manner between the sky near the sun, and the full moon, the latter taken with the full aperture of the lens, 3.65 centimeters, and the former with an aperture of .204 centimeter. Under these circumstances, with exposures of fifteen seconds, the moon and sky darkened the plate to about an equal amount. The result of a number of experiments indicated that the sky in the immediate vicinity of the sun was of about four hundred times the intrinsic brilliancy of the full moon. The ratio of the sky to the sun on this same day was fifteen hundred, so that the light of the moon was to that of the sun as one to six hundred thousand. In some experiments which I made in 1879,[1] I found the visual ratio was one to three hundred and fifty thousand. On account of the extreme blueness of the sun, it was to be expected that the photographic ratio should be somewhat higher than the visual one.

I next tried comparing directly the light of the sun and moon on the same plate, in order, if possible, to get a check on my results. The results, however, were unsatisfactory, the ratio coming out as 1 to 300,000, or only one-half the former amount. Owing to the difficulties of the experiment, this discrepancy may very well be referred to inaccuracies of the photographic plate, and changes in the sun's and moon's light during the course of the experiments. In all the results with regard to the sun, it must be remembered that the figures must be multiplied by 1.6, on account of diffraction. The two ratios, then, of the light of the moon to that of the sun, stand as 1 to 960,000, and 1 to 480,000; and of these, I think, in connection with my visual result, the former is the more correct figure. The moon at the time of these observations, June 26, 12 M., had an altitude of 29°, when the atmospheric absorption would amount to about twenty per cent.[1] Making this correction, we have the photographic ratio of the moon to the sun, as 1 to 760,000, or about twice as great as that to the eye. This is, of course, only an approximate result, as only very few observations were made, and as it was entirely outside the course of our inquiry.

Returning, then, to our original subject, we found the sky near the sun 400 times as bright as the full moon. Correcting for atmospheric absorption, this figure becomes 320 times. But we found before, that in order to detect the contrast between a coronal ray and a neighboring rift, the light of the sky must not exceed that of the full moon. It therefore seems that even in the clearest weather the reflected light of the atmosphere is 300 times too strong to obtain the faintest visible image of the true coronal rays.

In connection with these experiments, I took a few photographs of the sun with my improved apparatus. In order to still further diminish the reflection of the light from the surfaces of the lens, I so placed the telescope that the sun was almost completely hidden behind the high steeple of a neighboring church. A vast improvement in the results was at once obtained. The sun stood out sharply defined on a perfectly uniform background of blue sky. There was not the slightest trace of a fringe either where the steeple crossed the disk, or where the sky came in contact with the solar limb. The day was beautifully clear, and at six in the afternoon some more photographs were taken; but now, although the steeple was as clear as ever, all around the limb of the sun appeared the atmospheric halo, extending out in all directions, and gradually growing fainter as it receded from the sun. We may, therefore, in general, say, that with properly constructed apparatus, in perfectly clear weather, no halo whatever appears around the sun. It is only in slightly hazy weather, or as the sun approaches the horizon, that the appearances are produced which have been elsewhere described.

In brief, the result of my researches would seem to indicate, 1°; that without a total eclipse it ought to be impossible to photograph the solar corona, 2°; having tried, I have failed to photograph the corona, but have obtained the result which theory indicated.

WM. H. PICKERING.

[1] *Proceedings of the American academy of arts and sciences*, 1880, p. 246.

STEINEN'S EXPLORATIONS OF THE XINGU.

DR. KARL VON STEINEN has recently made a most interesting report of his explorations in the Matto Grosso,— the immense region, more than four times as large as France, which occupies a large part of central and western Brazil, and is hardly known to geographers except in the most imperfect manner. It is divided by great rivers, of which the Madeira, the Tapajos, the Xingu, the Araguaya, and the Tocantins flow northward, and the Paraguay flows southward. It is watered by innumerable streams which unite with these rivers, along whose banks live thou-

[1] *Annals Harvard college observatory*, vol. xiv. p. 62.

sands of the most primitive human beings. Steam-navigation exists on the Tapajos and Tocantins, and a railway is constructing along the banks of the Madeira. The Xingu is, however, almost unknown. Previous explorers have not reached beyond 4° south latitude, beyond which were supposed to be fierce tribes of cannibals. The primitive inhabitants of Brazil, retiring before the whites, were supposed to have concentrated themselves here as in a last stronghold. Between Piranhaquara and Paranatinga the river was absolutely unknown; and the existence of a water-way for trade to Para is a matter of the utmost importance to the inhabitants of the Matto Grosso, now confined for commercial purposes to the Paraguay.

The first part of the journey was made by land, and the latter part on the river. The military force commanded by Paula Castro worked with the civilians in perfect accord. They left Cayaba May 26, passing through the region of the Baicairis (partially civilized and friendly Indians), and after some delays, caused by the fact that the real distance was one-half greater than shown on the maps, they crossed the Paranatinga July 5, 1884, entering the unknown region, and travelling westward. The plain is a vast desert with an altitude of some twelve hundred feet, above which rise dunes of red sand and decomposed gravel to a further height of from two hundred to three hundred feet. The water was good, the grass very tall, but trees scarce and low, the vegetation being chiefly near the streams. Tapir and deer were seen, and a few birds, but the fauna is scanty. At mid-day the temperature was 80° F., but during the night it fell to 45°, and the party found great difficulty in obtaining game enough for food. Twenty leagues east from Paranatinga they found a river which they decided must be the Xingu. Making bark canoes, they began to descend it, meeting great difficulties: the river seemed to contain more rolling stones than water. In nineteen days, when they met the first Indians, they had passed more than a hundred rapids and four cataracts, of which one was fifteen feet high. Seven canoes were destroyed or wrecked: only six remained. Their provisions were almost exhausted, their clothing in rags, shoes worn out, and the men depressed by malaria and the labor of frequent portages, when every thing had to be carried on their shoulders around rapids. Aug. 30 they arrived at the mouth of the Batovi, and had reached more level country. Here three large rivers unite to form the Xingu, which is about a quarter of a mile wide. Numerous distinct tribes are located in this vicinity, all in about the same stage of culture. Surprised by the advent of the whites, they offered no hostilities, though fierce and untamed. They knew nothing of fire-arms. The reflection of the sun by a mirror alarmed them. One band of Suyas proposed a joint expedition against the Trumais, with whom they were at war. The Trumais live in villages of high round huts, several families in each. They cultivate manioc, maize, potatoes, and cotton, smoke wild tobacco, but do not know the banana. They do not hunt much, but shoot fish with arrows, and net them in pools. They have no spears, but kill wild animals with bow and arrow. They regard the flesh of the capybara as a delicacy, but do not eat that of the tapir or deer. Monkeys are eaten, their flesh dried and smoked for future use. They were much afraid of the dogs with the expedition: only one tribe had a name for this animal. The men go naked; they wear, however, strings of ornaments, teeth, shells, or nuts around the neck and waist, and a sort of cotton ribbon on the arms and legs. The women of most tribes wear a clout made of palm bark which could be put in a match-box. The Suya women wear absolutely nothing, although they know how to weave cotton hammocks, and make a sort of cordage of vegetable fibre. They do not know metals: all their tools are of bone and stone. Buttons were extremely desired. Steinen thought that with a gross of buttons he could have bought a house, field, food, and several wives. They are well proportioned. They practise the tonsure, shaving the crown with a very hard, sharp leaf resembling grass. They wear two feathers in their ears, and a diadem of feathers or straw. They play the native flute agreeably, and are fond of music. They ornament themselves at their feasts with bijous made of cotton or straw, or carvings of wood representing birds. In the houses are hung figures of animals coarsely plaited of straw, with some artistic merit. The Suyas, of whom only about a hundred and twenty were seen, are the terror of the other tribes. They are of greater stature, though absolutely nude, and wear a labret in the lower lip, and straw ornaments in the ears which reach to the shoulder. They cut the hair in front, and leave it long behind. They make baskets, hampers, and boxes of straw, and very perfect carvings of birds in wood. Their flute has three pipes of graduated size. They fight with heavy clubs ornamented with inlaid shell.

After leaving these people, another series of difficult rapids was encountered. The party were reduced to severe straits, were obliged to live on fish, two pumas which were killed served as a delicacy, fever prevailed among them, and their clothing was almost gone. Below the rapids they encountered a friendly tribe, the Yurumas, who were entirely ignorant of the people farther up the stream. These Indians sold them new canoes, and furnished guides. At last, on the 13th of October, the weary explorers reached Piranhaquara, the first outpost of civilization, almost naked and exhausted, but without the loss of a single man.

They had demonstrated the inutility of the Xingu as a trade route, but they obtained most valuable geographical and other scientific data in their traverse of the unknown region.

GEOGRAPHICAL NOTES.

The great work of Gen. Tillo on terrestrial magnetism in European Russia, has just been published by the St. Petersburg academy of sciences. All previous investigations have been laid under contribu-

tion, and the work is accompanied by diagrams, and a magnetic chart of Russia. Investigations in this direction have been very active recently in Russia. Besides the work of Tillo, Miller, Scharnhorst, etc., Schwartz has recently published in the 'Russki invalid' important researches on the magnetics of Turkestan, especially of the observatory at Tashkent.

Charles Rabot has finished a reconnoissance of the Norwegian glacial region, known under the general name of Svartisen. This work is the result of several years' explorations, during which the author received the kindly co-operation of the Norwegian general staff. It is based on a series of triangulations, with the details filled in by means of sketches, and photographs taken at determined angles and azimuths. The result shows a region about 125 kilometres long by forty-five kilometres wide, and divided by mountains into four principalg lacial bodies, but which, on the latest charts, is shown as covered by a single dome of ice.

The Military geographical institute of Italy has published a memoir on the mensuration of the area of the kingdom, and a new essay at the same. The figures are as follows in square kilometers: —

The peninsula of Italy	236,402.1720
The islets legally connected with its shores	368.8649
Sicily	25,461.2535
The Sicilian islets	278.8147
Sardinia	23,799.5607
The Sardinian islets	277.6027
Total	286,588.3—

This is about ten thousand square kilometres less than previous official figures, and two thousand less than Gen. Stebnitski's estimate.

The ethnography of the Austrian *litorale* has been deduced by Baron Carlo von Czoernig from the census of Dec. 31, 1880. The total is six hundred and eleven thousand in round numbers, of which 45.03 per cent are Italians, 32.27 Sloveni, 20.21 Croats, 0.35 Rumanians, and 2.14 German-Austrians, and others. Ethnographically, therefore, these coasts are Slavo-Italian.

Dr. Zélandt has just finished his great work on the Kirgiz, which will be soon published by the west Siberian section of the Imperial geographical society. It is divided into seven heads, treating of the history and archeology of Semirechinsk; of the resources of the central Tian-shan; of the life of the nomadic Kirgiz; of their social, commercial, and political institutions; of their ethnic relations; and of their temperament and culture. This work is supplemented by Katanaieff's recent memoir on the progressive movement of the Kirgiz of the Middle Horde, toward the Siberian frontier. A new chart of Russian-Turkestan, scale 1:42000, has just been issued at Tashkent.

It is announced that the work on the commercial geography of China, by Isidore Hedde, has been interrupted by the illness of the author, who has devoted twenty years to it, and was formerly a commercial agent of France in China. Two vol-
es still remain in manuscript, and will be printed
ient number of subscriptions are received by Paul Perny, care of the Société de géographie, Paris.

Dr. Ten Kate has just sailed for Surinam, with the intention of ascending the river of that name, crossing the Tumuc-kumac mountains, and descending to Brazil by the affluents of the Amazon River.

The recent expedition of Professor Chaffaujon on the Orinoco has been heard from. He had reached Caicara, and had prepared a map of the Orinoco and the region closely adjacent to its banks. In this work he was able to obtain much geological information, and discovered numerous pictorial and graphic aboriginal inscriptions, some of which seemed to be of the nature of writing. An immense mass of ethnological and natural-history collections had been made. Travelling was very expensive, and a large number of men were required to carry on the work.

Father T. Gaujon writes that Vidal Senèze, who had undertaken an exploration in the Chincha Islands, died at Guayaquil, and his collections were dispersed. The notes of his previous journey from Zumba to Bella Vista, reviewed by several residents of the region, had a certain importance; and the traveller, though without much training, had a spirit and an energy which make his death a loss to science.

A. Chaigneaux is about to take part in an expedition sent out by the Chilian government to the region where Crevaux lost his life, in Bolivia.

A CRAB INVASION.

AN interesting occurrence, that should be placed on record, has been recently reported by Mr. L. S. Foster of New York, superintendent of the Spanish American district of the American ornithologists' union. It consisted in the sudden appearance of countless myriads of young crabs on the seashore at Cape San Antonio, the western extremity of the Island of Cuba, where it was observed by Francisco Baritista y Ovenes, keeper of the lighthouse at that place. Specimens of the crabs were sent to the U. S. national museum by Mr. Foster, accompanied by the following extract from a letter by the lightkeeper, dated June 14, 1885: —

"After the light of the lighthouse had been extinguished in the morning of April 3, 1885, we went out on the gallery and saw at the edge of the shore, and at intervals farther out, large and small floating patches, of a reddish color, of what appeared to be wood, gulf-weed, or some other vegetable product of the sea. To our surprise, upon inspecting them more closely, we found these patches to consist of small living and moving bodies, belonging to the crab-family, being of that shape. I proceeded to measure the piles that were forming on the shore, and many of them exceeded one and one-half metres in size [probably diameter]. At eight o'clock in the morning, as more of the patches floated in shore, some of the piles increased to two metres. This multitude of marine animals came from the south-west, the wind and tide being from that direction; and the same phenomenon was repeated on April 9, and May 2 and

5. They approached the shore mostly during the night, the movement continuing, however, somewhat into the early morning hours. They invaded the houses and the yards, and the tower of the light-house up to a certain height, so that we had to brush them away with brooms and shovels, and finally to close the doors and windows, and cover the openings of the water-tanks with canvas and sacking. We lost three tanks of water corrupted by these little creatures. After sunrise they were nearly all killed by the heat, becoming whitish. A few that escaped to the shade lived a few days without growing any larger."

Prof. S. I. Smith of Yale College, to whom the specimens were referred, reports as follows respecting them: —

"The very small crabs from Cape San Antonio, Cuba, are too young and imperfect for precise determination, but are evidently the young, changed from the free-swimming megalops stage of some Grapsoid crab, probably a species of Sesarma. The four specimens are evidently all of the same species. They measure between four and five millimetres in width of carapax." R. Rathbun.

TYPES OF ETHICAL THEORY.

Dr. Martineau (it is a pleasure to remember that this country had the honor of giving him his title) has already reached his fourscore years, yet his work shows no sign either of labor or of sorrow. Its characteristics are indeed precisely the reverse of these: they are facility and optimism. There is the same dignified eloquence which made George Eliot write, in 1853, "James Martineau transcends himself in beauty of imagery." There is the same calm faith which has always possessed him in the outcome of the philosophical controversies of the time. For forty years he has stood quite alone among English theists in his breadth of sympathy and his sweep of style; and there is much pathos to many a grateful student in the words with which he dismisses this work, hoping to deal with further problems, "in case the evening twilight of life should linger a little longer with me, and leave my powers of industry still unspent."

It is impossible to review such a book as this with any completeness, within the limits which must be here observed. It is the ripened fruit of a lifetime, and it must be recognized, as has been done by the *Spectator*, as the most important ethical work of this generation. It traces the great types of ethical theory, advancing with "many companions, stately or keen, severe or facile, mystic or humane," until the view of the author is set in final and striking contrast with that of the so-called English school. Here, to most readers, is the central interest of the book. It is Kantian ethics in the hands of a master of style over against the laborious inadequacy of Mr. Spencer. Nothing can be more delightful than the ease and brilliancy of this discussion, or more honorable than its recognition of the worth of the opposing school. "The representative writers of this school," Mr. Martineau concludes, "have in truth theorized in one language, and felt in another, and have retained ideal conceptions of a scale of good, and admirations for types of character, for which their doctrine can find no corresponding place. Nor is this an accident of their individual presentations of the theory. So long as it sets itself to find the moral in the immoral, to identify the order of right with the order of strength, to repudiate any study of what ought to be except in studying what has been, is, and will be, it totally shuts the door in the face of all conception and possibility of duty, and by naturalizing ethics reverses the idealizing process which rather ethicizes nature. It subjugates character to science, instead of freeing it into religion."

Two sources of embarrassment are here hinted at, which are felt throughout the work. The one is the loyalty of the writer to the terminology of the school in which he has been reared. This is so marked in the presentation of the author's own theory, that the hasty reader may fancy that he is dealing once more with that analysis of faculties which used to satisfy the writers on ethics, and which made the study so dreary. "The virtues and vices, the appetites, emotions, and affections," some one has said of that earlier school, "stood each in its appointed corner, and with its appropriate label. Never before had human nature been so neatly dissected, or so ornamentally packed up." It is not until one has penetrated through this somewhat repelling method, that he discovers the wealth of insight which Dr. Martineau's treatment exhibits. The other source of embarrassment is more serious. It is the obvious conviction of the writer that the principles of ethics cannot be finally described apart from their relation to religion. After all is said and done, human nature remains, as Mr. Bradley most forcibly points out in his 'Ethical studies,' a contradiction whose solution compels one to the religious attitude. Dr. Martineau constantly hints at this necessary incompleteness; and

Types of ethical theory. By James Martineau, D.D., LL.D. 2 vols. Oxford, *Clarendon press*, 1885.

ce promises that the philosophy of hall be his next task. How the relathics to faith would be developed by be seen in his very remarkable lecture ubject, delivered in 1881. Here his its natural flight, unhindered by conor by ethical limitations.

rn, finally, from these very insufficient ns of the contents of the work to a ment in it which will be novel to most and interesting to all. Dr. Martineau his preface to describe the personal es which gave its character to his d in so doing he offers us a most fasand instructive glimpse of his own in- autobiography. It seems that he nally trained to be a civil engineer, first philosophical studies were con- scientific conceptions. "So self-evicared the maxims of mechanical cauat in my heart I deemed it blindness if professed a different vision." . . . o wonder, that, in skimming over my work in those distant years, I seem to uning with some tight-swathed, logiin whose jerky confidence and angucry I am humbled to recognize the myself." It was the discipline of these subjects which changed his et the change was not so obvious to as it was to his friend, J. S. Mill. h he saw to the bottom of my apostasy, ot cut me off as a lost soul." Finally, e guidance of Professor Trendelenthe inspiration of Greek philosophy, l what he describes as a 'new intelirth.' "It was as if the stereoscope which I had looked at Plato or Arishad its double picture, — Greek and — with distorted halves, producing urred and overlapping flat; while now of true correspondence was there, eye, after a momentary strain of adapeheld the symmetrical reality in all its ns." . . . "The metaphysic of the d come home to me; and never again say that phenomena, in their clusters ns, were all." To many a student there othing of more value in these volumes se suggestions of what the author calls nsitions of his thought, and the testing his life." FRANCIS G. PEABODY.

OF THE CHALLENGER EXPEDI—III. GEOLOGICALLY VIEWED.

the work of a dredging and sounding on should add much to our knowledge of the geology of dry land, except by inferences from submarine formations, is hardly to be expected. Nevertheless, this report contains many facts and observations useful to geologists. Several of the phototype plates are extremely striking illustrations of geological phenomena, showing more on one sheet than many pages of text would do. Such, for instance, are the plates illustrating glacial markings in Nova Scotia (i. p. 158), the trap-hills of Kerguelen (p. 338), and the wonderful lava cascade of Kilauea.

Only two of the series of special reports, actual and projected, treat of essentially geological matters; one already printed being on the petrology of St. Paul's Rocks, by Prof. A. Renard. These rocks, far removed from any continent, consist of a number of small islets separated by deep chasms, through which the ocean unceasingly pours and rises into breakers. The rock-mass, according to Professor Renard, is peridotic; and, while admitting the possibility of the volcanic origin favored by analogy, he has been led, rather, to presume that the rocks are a remnant of upheaval of an orographic character. This view has been opposed by Professor Geikie, and in this journal by Mr. Wadsworth (*Science*, i. 1883, p. 590), and would seem yet unestablished.

The second report referred to is that of Dr. Murray, on the deposits of the deep-sea bed. One of the most attractive plates in the work before us is that (p. 926) illustrating the ooze formed by the diatoms, radiolarians, foraminifera, and other organic remains on the sea-bottom, as seen under high magnification. After the removal of the calcareous portions, and the determination of the carbonic acid, the remainder is divided by Dr. Murray into mineral matter, the *débris* of siliceous organisms, and fine sediment. The material found in inland seas and along continental shores consists in large part of terrigenous deposits, the different colored muds and sand, and volcanic *débris* of inorganic origin; while corals and corallines afford sand and mud of organic origin. The abyssal deposits, on the other hand, in large part, seem to consist of ooze derived from remains of minute animals, such as pteropods, diatoms, etc., and especially of a red clay such as results from the degradation of the ooze and of decomposed pumice. The transition between the former and the latter is gradual, but in the great deeps the clay almost exclusively predominates. The terrigenous deposits reveal the equivalents of chalks, green sands, marls, or shales, but in the deep-sea deposits, according to Dr. Murray, differ pro-

foundly from the series of rocks known in the geological formations. The latter present no analogies to the red clays and oozes, in which, for instance, quartz may be said to be practically absent. The deduction from this is made, that the deeps are of great antiquity. In order to account for such vast accumulations as were there discovered, it is necessary to suppose that these basins have remained the same for a vast period of time.

From the red clays south of the equator, quantities of ear-bones of whales, sharks' teeth, etc., were obtained, which were embedded in nodules of peroxide of manganese, derived from the salts of that metal contained in the sea-water. Some products of volcanic eruptions also occurred, and, more interesting than either, certain spherules for which a cosmic origin is confidently claimed. These are mostly extremely small (not more than a millimetre or two in diameter), and may be collected from the dry and powdered ooze by a magnet. These contain sometimes a centre of meteoric iron coated with magnetic oxide, sometimes what seems to be an alloy of cobalt and nickel: others are chondritic, and appear to consist of bronzite or enstatite. All these are characteristically meteoric minerals; and it is indeed remarkable that the investigations of a Nordenskiöld in the arctic snows, should, in their proof of the gain of this planet by the deposit of cosmic material, be upheld and augmented by an investigation of the abysmal ooze of the great deep.

To the narrative are appended, among other documents, a bibliography, sufficiently exact for general purposes, of papers and publications, official and otherwise, to which the voyage has given rise. There is a list of the special reports already printed (more than forty), and of nearly as many more to follow. The concluding part will include an index to the whole, which it is to be hoped will be intrusted to a competent person for preparation. There is a science of indexing, to which we are confident the person who indexed this narrative never served an apprenticeship. Considering the importance, variety, and multitude of facts recorded in these pages, and that there is no systematic arrangement of them in the text, a really thorough, sensible, and scientific index was indispensable. The one which exists, though voluminous enough, is far from meeting the least of these requisites. In this particular, and a few others, we have, as it were, indicated a few spots upon the sun; but we should do much less than justice to the editors, and to the authorities who have sanctioned the work, were we to omit a distinct enunciation of the opinion that it, and the series it is intended to introduce, as a whole, form the most magnificent contribution to natural science, and monument of enlightened research, which has ever been given to the world in any age or by any country.

THE CHALLENGER REPORT ON THE STALKED CRINOIDS.

This magnificent work, which has just been issued by the British government, is beyond question the most important contribution to the literature of the living crinoids since the days of Johannes Müller. When Müller wrote his classical work, 'Ueber den bau des Pentacrinus caput medusae,' in 1841, but a single species of stalked crinoids from the existing seas was known. Carpenter now describes six genera, with thirty-two species, of which two genera and eighteen species were brought to light by the Challenger. In the present report he describes also the remarkable comatulid genus, Thaumatocrinus, obtained from a depth of eighteen hundred fathoms, which has underbasals, and interradial plates interposed between the first radials, and a row of anal plates, thus combining, in a measure, the characters of recent and paleozoic crinoids.

The work, though primarily a report upon the crinoidal collections of the Challenger expedition, is, in fact, an almost complete monograph of all recent stalked crinoids known to this time. The descriptive part and illustrations are so excellent and copious as to leave nothing to be desired in this particular.

A large portion of the volume is devoted to comparative discussions of the morphological relations between recent and ancient crinoids, to which he has brought all the resources of a mind equipped with the most varied and accurate knowledge of both living and extinct forms. The importance of this portion of the work in stimulating further researches cannot be overestimated.

In his classification, Carpenter follows Leuckart, and separates the stalked echinoderms from the remainder of the group, under the name 'Pelmatozoa,' which he makes a 'branch' of the 'phylum' Echinodermata, with three 'classes,'—Crinoidea, Cystidea, and Blastoidea. The Crinoidea are the strictly brachiate Pelmatozoa, for which Burmeister, in 1856, proposed the name 'Brachiata,' taking rank with

Report on the Crinoidea dredged by H. M. S. Challenger during the years 1873-76. Part I. General morphology, with descriptions of the stalked crinoids. By Dr. P. Herbert Carpenter.

ithodiata,' under which he placed the a and Blastoidea as sub-groups. The lea, no doubt, are readily separated from Crinoidea; but the two groups are so linked together by the Cystidea, that it mely difficult to assert whether certain e crinoids or cystids, or whether others ids or blastoids. For instance: Caryo- nd Porocrinus have well-developed free ut possess calicine pores; while Hybo- on the contrary, has cystidean arms calicine pores. Similar transitions the Blastoidea with the Cystidea; and rcely doubtful that crinoids sometimes drospires. These difficulties do not be wholly met by Carpenter's arrange- or indeed, it must be confessed, by any yet devised.

arpenter's discussion of the relations Neocrinoidea to the Palaeocrinoidea e studied by every paleontologist who something more than mere empirical ons. He ranks the two groups as dis- lers, and points out very clearly their l differences. In the course of these ns he directs special attention to the tes of the Palaeocrinoidea. These e thinks, are represented by the so- roximals,' or ring of plates surround- central piece, which he regards as nding to the basals in the abactinal He calls the central plate the 'oro- and considers it an actinal representa- ie 'dorsocentral,' the terminal plate of nn. From one point of view, this the- ars plausible, considering that there is entral in ophiuroids and starfishes within the ring of basals; but it is to understand what function such a ld have had in the oral system, since e compared with the base of the col- rinoids, while no echinoderm, at any f life, or in any group, was ever at- y the oral side.

mits of this notice do not warrant fur- tion of the details of the book, much ssions; but the work challenges ad- in almost every requisite of a scientific Dr. Carpenter's style is clear, vigor- incisive. Those who venture to cross ith him in scientific disputation will do refully measure their strength; for they a most formidable antagonist, fully all points, vigilant to discover, and strike at the weak points of an argu- With all this, it is a pleasure to observe ent candor and fairness of his treat- controverted questions. Those who dispute with him are not allowed to forget that the ultimate aim of all such discussion is not a victory of words, but the discovery of the truth.

NOTES AND NEWS.

THE Chesapeake zoölogical laboratory, as the marine station maintained by the Johns Hopkins university is designated, is established for the present summer session at Beaufort, on the coast of North Carolina. Dr. W. K. Brooks, the director, who was prevented last year by ill health from giving as much time as usual to the laboratory, is fortunately quite restored to his usual strength, and is in full activity at his post. Twelve collaborators are with him, — Messrs. Andrews, Bruce, Haldeman, Hemmeter, Herrick, Howell, Jenkins, McMurrich, Mills, Morrell, Nachtrieb, and Shimek. Several of these are already teachers in various branches of zoölogical science, and all of them are well prepared to make use of the opportunites which are afforded at this station. An unusual number are engaged in original researches. On account of the limited accommodations, the director was unable to receive three other persons who applied for admission. The season of 1885, although uncomfortably hot, has thus far been exceptionally favorable for collection. The weather has been calmer than heretofore in June and July, and specimens were found in June which have usually not appeared until the middle of August. The company, notwithstanding their personal discomfort from the heat, have maintained their full enthusiasm in the work upon which they are engaged; and it now appears as if the eighth session of the laboratory would be more fruitful in results than its predecessors, good as they have been. It is too early to speak of the investigations which are in progress, but reports will be made upon them in one of the Johns Hopkins university circulars to be published in the early autumn.

— A cable message to Harvard college observatory, from Dr. Krueger, at Kiel, announces the discovery at Nice of Tuttle's comet (1858) on its expected return. The position received is as follows: August, 9 6124*d.*, *Gr. M. T.; R. A.*, 7*h.* 23*m.* 43.1*s.; Decl.*, +28° 1′ 24″.

— Prof. J. E. Hilgard, who has just resigned from his position as superintendent of the U. S. coast-survey, was born in Zweibrücken, Germany, in 1825. His father, a lawyer by profession, emigrated to Illinois in 1835, with a family of nine children, and was a man well known for his writings on social questions. J. E. Hilgard was educated as a civil engineer, and in 1845 entered the coast-survey: he was specially interested in geodetic methods and the tides and terrestrial magnetism. In 1863 he was made a member of the National academy of science, and in 1872 took an active part in the international metric commission in Paris, and was made one of its permanent committee; and it was in that year he

made a determination of the difference in longitude of Cambridge and Greenwich by means of the Atlantic cable. At his suggestion, the series of transcontinental triangulations have been run connecting the surveys on the Atlantic and Pacific coasts, — triangulations which are serving for some of the state-surveys now in progress. Professor Hilgard was especially interested in the study of the Gulf Stream; and many will remember his paper upon that subject read at Philadelphia last summer, but not yet published. The success of the coast-survey is largely due to his work; and, since 1881, he has been the superintendent, from which position the misfortunes of ill-health compelled him to resign.

— Mr. Bosworth Smith has been appointed mineralogist for the Madras presidency. The local government order says he is "to create in the Central museum a perfect index to the mineral wealth of the presidency, and to begin a mineralogical survey in consultation with Dr. Bidie and such other officers as government may instruct him to communicate with."

— The commander of the German gunboat Prinz Adelbert reports that on the 10th of February last, at half-past one A.M., in the roadstead of Aucon, two short earthquakes were felt which lasted ten seconds, and were noticed very perceptibly on board ship. The disturbance seemed to travel from south-west to north-east. The first sound heard was like that of steam let off under water, and escaping to the surface. This soon increased to a thundering, rolling noise, like the sound of river-ice breaking up. The damage done by this convulsion of nature was very insignificant on shore, and no casualties have been reported at sea.

— The German Seewarte has received a bottle which was set afloat by the German bark Suahali, Capt. Fröhling, on the 18th of November, 1883, in 0° 40′ north latitude, and 21° 40′ west longitude. On the 4th of February, 1885, four hundred and forty-four days later, this was picked up in the neighborhood of the life-saving station at Fort Laundersdale in the Straits of Florida, in about 26° 10′ north latitude, 80° 05′ west longitude. The end of the bottle's drift was about thirty-seven hundred and forty nautical miles distant from where it was set afloat, in a N. W. by W. ½ W. direction. It is more probable that instead of taking that direction which leads through the Providence Channel, and then across the strongest part of the Gulf Stream, the bottle first drifted with the equatorial current west-north-west, then north from Trinidad into the Caribbean Sea, south of Jamaica, and by Cape San Antonio into the Gulf of Mexico, and finally with the Gulf Stream through the Straits of Florida to the place where it was found. According to this hypothesis, the drift was about forty-five hundred and fifty nautical miles for the four hundred and forty-four days, which makes an average daily distance of ten miles and a quarter. The Seewarte has also received a bottle which was thrown overboard from the German bark Suahali, on the 9th of December, 1884, in 44° 02′ north latitude, and 13° 16′ west longitude. It was found on April 8, 1885, at Buen in Ponte Vedra Bay, west coast of Spain, in about 42° 19′ north latitude, and 8° 45′ west longitude. So the bottle had probably drifted, in a hundred and twenty days, two hundred and twenty-three miles S. E. by E. ½ E.

— The crystalline form of quartz grains in some sandstones has been seen by many observers, while especial attention was called to these forms in the Wisconsin sandstones by Rev. John Murrish in 1870 and later. Mr. H. C. Sorby, in 1880, showed that such crystal forms were produced by the deposition of secondary quartz upon the irregular rounded surfaces of worn quartz grains. For the Wisconsin sandstones, the subject was taken up by Rev. A. Young, and later by Messrs. R. D. Irving and C. R. Van Hise, who have published an extended and valuable paper (*Bull. U. S. geol. surv.*, No. 8), with full illustrations, relating to the enlargement both of quartz and felspar grains; and for this the thanks of all micro-mineralogists and lithologists are due. Our authors conclude that their results prove that most, if not all, of the ancient quartzites, as well as many of the quartziferous schists, are composed in the main of fragments cemented together by a secondary siliceous cement.

— By the gift of the Hon. Elbert E. Fairman, LL.D., of Warsaw, N.Y., all that remains of the collection of birds made by the famous John J. Audubon is now in possession of Amherst college, Massachusetts. There are about six hundred skins of birds in the collection, some of which are labelled in the handwriting of Audubon himself, and many of which are the typical specimens by which the species were determined. As the collection has been stored in camphor chests for the last few years, and the skins were unmounted and old, many of them could not be advantageously mounted. About one hundred of them, however, have been handsomely put up by Prof. H. A. Ward of Rochester, and are now well exhibited in the Appleton cabinet of the college. Also there have been added to this collection by the same donor several of the rarer California birds, which have been discovered since the death of Mr. Audubon.

— The Paris students, according to *Nature*, are making extensive preparations for celebrating the one hundredth birthday of Chevreul, the veteran chemist, who has been a member of the Academy of sciences since 1826.

— A movement is on foot in Christiania, says *Nature*, at the instance of the Society for the promotion of the Norwegian fisheries, for the establishment in the Christiania fiord, near Dröbak, of a biological station for the hatching of sea-water food-fish and salmon, in consequence of the great success of other stations along the coast.

— The American ornithologists' union will hold its next meeting in New York on Tuesday, Nov. 17.

— The expedition which the Norwegian government despatches this summer to the coast of Finland is to ascertain whether there are banks or fishing-grounds far from the coast. Hitherto all fishing has been confined to the shore.

SCIENCE.

FRIDAY, AUGUST 21, 1885.

COMMENT AND CRITICISM.

ANNOUNCEMENT IS MADE in another col-
y Dr. C. S. Minot, that Mrs. Elizabeth
son of Stamford, Conn., has given to a
of trustees the sum of twenty-five thou-
llars "for the advancement and prose-
of scientific research in its broadest
It is a generous gift for a noble pur-
With a degree of wisdom which is for-
y more and more evinced by those who
ndowments, the methods to be employed
accomplishment of these ends have
t by the donor to the judgment of those
she intrusts with the fund. They are
whom the public will also have confi-
One of them is a physiologist, one an
mer, one a political economist, and one
gist. The income will soon be avail-
nd the founder may hope to see within
year good work in progress, which her
y has made possible.

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is been suggested that the fund thus
hed should be administered by an inter-
l association of science, if such a body
ated by the British and American asso-
. This would doubtless give *éclat* to
w organization, but diffused responsi-
by no means essential to the success
fund. A small body of trustees, such
now instituted, is quite adequate to the
n of the project, particularly if its en-
and its results are made known to the
y annual reports, which may evoke the
its and suggestions of other scientific
But whichever form of direction may
ly adopted, the far-sighted and gener-
will be everywhere recognized as de-
the gratitude of all who believe in the
s of science, and the endowment of
. We welcome as a new agency in
the promotion of knowledge, 'The Elizabeth Thompson science fund.'

WITHIN A FEW YEARS a change has been effected in the organization of the American association, through a considerable increase in the number of its sections. In its present composition, it resembles much more than formerly its prototype, the British association. The change was a necessity of the immense recent growth of our association. There is another desirable change, not so radical, but in its future significance quite as important, which would be in keeping with the example of the British association, and which, even if entirely within the province of the standing committee to carry into effect, should receive the countenance of the members at large. This concerns its annual volume of proceedings. Means of publication have now so vastly increased in all parts of the country, that there is no longer need of this one additional channel of communication with the outer world; and the publication in full of all the papers read at any meeting (which has never been attempted in recent years) would absorb at once all the increasing income of the association. A considerable number of the papers are printed only by title, most of the remainder only by abstract; but the abstracts are apt to be of undue length, and a considerable number of papers are printed in extenso.

The change which we would advocate is, that *all* papers should be printed in the 'proceedings' either by title, or by brief abstract only. Should any papers prove of such exceptional interest that they should be printed in full (and desirable, as would then be the case, that they should appear under the auspices of the association), it is also manifestly important that they should be published by the association without delay; which, under the

present arrangements, is impracticable, as no volume of proceedings has been issued in recent years under ten or eleven months. This year it is twelve. Let such papers then be printed in quarto form under the title of 'memoirs' (a series already commenced), and issued one by one as fast as printed: even with this elimination and restriction, the volume, with the growth of the society, will become quite as large as should be issued by the association with its limited funds and its liberal rules of distribution. The members would receive an acceptable *quid pro quo*, containing a fair statement of the work of the association and the industry of its members. Such an action would, as it should, elevate the presidential addresses to a higher dignity; while, more important than all, it would free the association from a heavy monetary burden, and enable it, as it otherwise could not, to devote a not unimportant part of its annual receipts to annual subsidies for special research. The association would thus be enabled to take the place that belongs essentially to it — of fostering 'the advancement of science' in the most effective manner.

Another evidence of the necessity of restriction, in expenses of astronomical establishments, comes from abroad. In his last report, Admiral Mouchez, director of the Paris observatory, noting the fact that the publication of the *Bulletin astronomique* entails great outlay of the resources of the observatory, expresses his apprehension, that, unless the list of subscribers to the periodical is largely augmented, the journal must soon be discontinued. *Bulletin astronomique* is a monthly of the highest value; and, although very young, it would be greatly missed. The first number was that issued for the month of January, 1884.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Meteoric activity, Aug. 10.

On the 10th of August last, the date of meteor activity, it was noticed about ten o'clock in the evening, that meteors issued very frequently from the constellation of Perseus. They increased in number hourly, until about two o'clock in the morning they attained their maximum frequency, which was about one hundred and fifty every hour. After this the number per hour grew less frequently until four o'clock in the morning, when they fell, as in the early evening, about fifty each hour. The majority of meteors were of the third and fourth magnitude, and from two to three degrees in length. The finest meteor of the evening issued from the constellation Perseus, took a north-westerly course, and disappeared behind the horizon. It was of the first magnitude, and silvery in color. The passage of the meteor was marked by a train resembling steam, which did not disappear for over a minute. Many other meteors were observed during the evening, but all were less brilliant than the one described. Two were seen directly south, and a few south-west; but the majority issued from the constellation of Perseus.

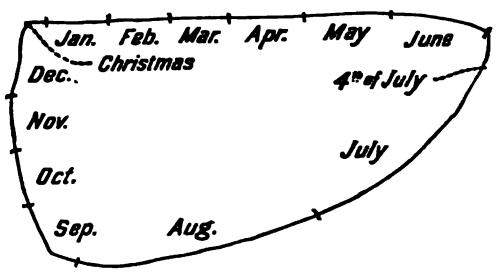
Darwin Myers.

Fort Wayne, Ind.

Color associations with the months.

Noticing in *Science* of July 31 a letter on 'color associations with the months,' I would call attention to a geometrical association that I have unconsciously acquired, and that is ever present in my mind when thinking of any date, or period of the year. The curve is represented in the subjoined sketch. The divisions represent months. Several, as you observe, appear longer than others. The plane in which this curve is described appears to me inclined at an angle of about 40° with the vertical. Its longest diameter is perhaps two hundred yards. From day to day I seem to move along this imaginary line to positions corresponding with the date.

Notable days, as Christmas and Fourth of July, stand out as distinct marks in the curve. It appears, not as a black line, but as a portion of space only

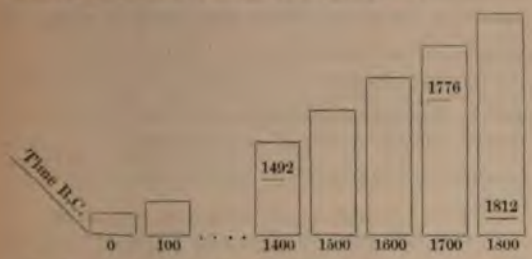


defined by marks here and there denoting days on which something occurred that I remember. My supposition as to the origin of this unnatural and rather unpleasant notion of the months, is, that, when a child at school, the impression made upon my mind by my every day duties was similar to the emotions one would feel in walking around a curve arranged as this is. Entering school the middle of September, there was, until Christmas time, hard, up-hill work. Then for one week, until Jan. 1, a period of rest, after which things would go easier by my being accustomed to them, and looking forward to the spring. During June the curve begins to bend down; and, through July and August, there is perfect rest, as though one were sliding down with no exertion, until towards September the thought of again assuming the duties of school-life puts a stop to the downward motion, and the curve begins to ascend in September. On this supposition it is hard to explain why July and

August are so much longer than the other months. This impression of the months applies only to the current year.

When thinking of any event that occurred more than one year ago, I have an entirely different scheme presented. The second figure illustrates it. The centuries are arranged in columns, decreasing in length until the Christian era, beyond which the lapse of time is denoted by an inclined line here shown.

Important dates I think of as lines crossing these columns; and the life of a noted man, or a war, as the space included between two such lines.



I should have said, that in these columns the decades are marked by especially distinct lines. It seems to me there is in these mental associations a large and interesting field for study; and I, for one, would be glad to hear other facts bearing on the subject.

C. RUHEIT.

New Haven, Aug. 6.

The classification and paleontology of the U. S. tertiary deposits.

In the issue of this journal of June 12, Prof. A. Heilprin condemned the second part of my article on the genealogy of the tertiary mollusca of the United States *before* it had been published. Since its appearance, moreover, he has again recurred to the subject in a note in *Science* of July 31. I would here beg permission to defend myself from the charges that he brings forward.

I have shown that the literature affords no evidence, either paleontological or stratigraphical, that the Vicksburgian is the most recent formation; and have given a number of reasons, based upon profiles which I have observed, showing that this bed is most probably the oldest. Professor Heilprin, however, has nothing whatever to say on these subjects. What, then, does he say?

1. "It might appear . . . that the paleontological evidence was in conflict with that derived from stratigraphy. As a matter of fact, however, the paleontological evidence . . . is, as we now know it, absolutely confirmatory of the pregnant facts which the stratigraphy of the region presents; and, indeed, it would be difficult to find a region of similar deposits where it is more so." When he wrote this, Professor Heilprin must have entirely forgotten what he himself had published on the fossils from Wood's Bluffs, (Proc. ac. nat. sc. Phil., 1880, 364–375). There he points out, in spite of certain wrong determinations, clearly and in extenso, the conflict between paleontological and stratigraphical evidence (see pp. 368, 369).

2. "The absence or scarcity of forms of a distinctively old-type facies in the Vicksburg beds, and the introduction there of new forms whose equivalents or immediate representatives are known only from the newer horizon, are sufficient in themselves to establish the position." This statement of Professor Heilprin is new and wholly without proof. My studies lead me to precisely the opposite view. In the Vicksburgian are contained the old forms, while in the Claibornian the new ones make their appearance. The facts upon which I base this statement will be given in another place.

3. I have contested the right to consider and map all localities with Orbitoides as oligocene. Professor Heilprin objects to the older authorities, hence I will here quote the following very recent one. Zittel's Handbuch, vol. i., Munich, 1876–80, p. 103, says, "Orbitoides . . . In der obersten kreide, sehr verbreitet im eocän, im miocän selten." If Professor Heilprin can cite any authority, stating that Orbitoides occur only in the oligocene, I shall be very glad to have him do so.

4. Then Professor Heilprin speaks of Zeuglodon. He argues, Zeuglodon is 'leitfossil' for the Jacksonian; it is known in Europe in late eocene or miocene deposits, hence the inference is that the Jacksonian must be late eocene (or miocene?); the Claibornian is middle eocene (Parisian), consequently the Jacksonian overlies the Claibornian. To give to this argumentation some weight, it will be necessary for Professor Heilprin to prove: *First*, That Zeuglodon occurs only in the Jacksonian, and not elsewhere in America. Having studied the known *facts* which have been published, and having myself seen and collected Zeuglodon at different localities in the South, I have as yet not found evidence to convince me of the truth of this statement. *Second*, That he has a right to parallelize the Jacksonian with any European bed from the presence of a single genus. I found a small bivalve in Jackson, which I should compare with specimens of the genus Kelliella, Sars. If, however, a genus (not a species) can be determined from figures and descriptions alone, there can be no doubt that this fossil belongs to this genus, hitherto only known as recent (and pliocene?) in Europe. Has any one a right to draw from this the conclusion that the Jacksonian bed is recent or pliocene? *Third*, That the Claibornian is middle eocene. My studies and comparisons have demonstrated to me that it would be a laborious and difficult task to parallelize the sub-divisions of the American old-tertiary with those of the European. So far as I am aware, my material for this purpose exceeds that of any other collection. Hitherto I have ascertained nothing to prove that the Claibornian is middle eocene, although it may yet be proved. If Professor Heilprin can prove two of these three-mentioned points, without the third one, there will be nothing convincing in his argument 'to the mind of any unprejudiced paleontologist.'

5. "In that which relates to the oligocene (Orbitoide, Nummulite) rock of Florida, whose existence appears to give Dr. Meyer a considerable amount of anxiety, and which would better suit the requirements of the new theory were it cretaceous, our author need entertain no doubts. The rock is there," etc. I have not the least doubt about the existence of orbitoidic limestone in Florida, observed by E. A. Smith, nor have I anywhere expressed such. This limestone causes me no anxiety whatever. I fail to see why this limestone, if Vicksburg is the oldest bed, should be cretaceous. I have nowhere expressed this belief, nor do I think it will prove to be of this formation. All that I have said is, that there is no reason to map as oligocene localities where orbitoidic limestone is observed, or the larger areas, where nothing at all has been observed.

6. "In such inquiry, it is necessary, however, to

[illegible] Professor He[illegible] [illegible] I have [illegible] I [illegible] [illegible] [illegible]

ing the cost of scientific researches. The board of trustees consists of five members: Dr. Henry P. Bowditch, chairman; William Minot, jun., treasurer; Prof. Edward C. Pickering; Gen. Francis A. Walker; and Dr. Charles S. Minot, secretary. It was considered important to have as great a variety of interests represented as possible, and this is accomplished by the association of the above gentlemen.

When the International association is organized (and it is hoped that the movement will be initiated by the British association at Aberdeen), the income of the fund will presumably be expended under the direction of that new association; until then, under the direction of the trustees. The first appropriation will probably be made next autumn, when several hundred dollars will become available. At the proper time a circular will be issued, announcing the manner in which applications may be made. As it is desired to give the fund an international character, it is hoped that foreign journals will copy this notice.

In conclusion, I wish to express my admiration for the wisdom shown by Mrs. Thompson. It is certainly very remarkable that a person not especially versed in science, nor directly interested in any of its branches of investigation, should be induced by a desire to benefit her fellows, not to give for some temporary need, but, with exceptional insight, to give for the development of the very sources of progress. The same sound judgment governed her decision as to the conditions of her gift, for it is difficult to foresee any probability which will render this endowment futile. Very often the object of a public gift is determined by the donor's personal interests. I believe Mrs. Thompson was governed by her convictions as to the application of her money which would do most good. She is a devout person, and trusts in the peaceful union of true religion and true science.

At their first meeting the trustees voted unanimously to call their trust 'The Elizabeth Thompson science fund.'

Charles Sedgwick Minot.

THOMAS ALVA EDISON.

Thomas Alva Edison was born at Milan, Erie county, Ohio, on the 11th of February, 1847. His ancestors on his father's side were of Dutch descent, having emigrated from Holland to the United States in 1730. His mother, Mary Elliot by name, though a native of Massachusetts, was originally of Scotch parentage. She had for some years taught in a Canadian high school, and was possessed of an excellent education. Under her careful training, her son, in the almost entire absence of the ordinary educational privileges, developed very early a fondness for books, which became almost a passion. Before he was ten years old he had read not only Newton's 'Principia' and Ure's 'Dictionary,' but also Hume's 'England,' Gibbon's 'Rome,' D'Aubigné's 'Reformation,' and Burton's 'Anatomy of melancholy;' and at the age of twelve he undertook the task of reading through the public library of Detroit in course, becoming convinced, after wading indiscriminately through fifteen feet of shelving, that it would be better for him to make a selection of works upon his favorite subjects.

In 1854 the Edison family removed to Port Huron in Michigan, and a few years later young Edison became a train-boy on the Grand-trunk railway. When the line was completed between Port Huron and Detroit, he secured the exclusive right upon it as news-agent, employed four or more assistants, fitted up a printing-office in the baggage-car, and issued therefrom a weekly journal called *The grand-trunk herald*. While thus occupied, he became interested in telegraphy; and having, at the risk of his own life, saved a little boy from being crushed under the train, the father, a station-master upon the road, assisted him to become an operator. So assiduously did he apply himself, practising often the entire night, that at the end of five months he was given in charge the telegraph-office at Port Huron.

As a telegraph-operator his career was a checkered one. He was employed chiefly for night-work in positions of increasing importance, until finally he reached the larger offices of Indianapolis and Cincinnati. Everywhere his desire for information, his originality in suggestion, the novelty of his speculations, his exemplary conduct, and his uniform good nature, won for him the regard and esteem of his associates. In 1864 he went to Memphis as a government operator; and thence he removed to Louisville, where he remained two

years. Here he wrote and printed a book on electricity. He also experimented to devise the best style of penmanship for telegraph-operators, selecting finally a slight backhand, with regular round letters apart from each other, and not shaded, attaining himself by its means a speed of forty-five words a minute. He subsequently operated in Cincinnati again, and in 1868 removed from there to Boston, where he was put in charge of a heavy wire to New York.

It is as an inventor, however, that Edison is best known in the community. His first invention was an automatic telegraph-repeater, and was made in 1863, while an operator in Indianapolis, though it was not put into practical operation until some time afterward, at Memphis. It was while operating at this latter place that the possibility of duplex transmission occurred to him. And although the instruments required to test his method were constructed while he was in Cincinnati, it was not until 1870 that they were actually tried upon the line. On reaching Boston, he found an appreciative friend in Mr. Milliken, under whose active encouragement his inventive talent rapidly developed. He devised a dial or indicating-telegraph for local lines, a chemical-recorder for voting purposes, and a private line-printer, experimenting at the same time, between Boston and Portland, on vibratory telegraph-instruments.

His experiment on duplex transmission was made between New York and Rochester, and proved unsuccessful. Penniless and disheartened, he went to New York in search of employment. Chancing to be in the office of the Gold and stock company when a serious breakdown of their apparatus occurred, the officials, in despair, allowed Edison, then unknown to them, to try his skill upon it. His success showed his ability, and he was at once given an important position. Soon afterward the Western union telegraph company and the Gold and stock company entered into a joint agreement with Edison, by which he bound himself to give them the first refusal of all his inventions relating to telegraphy. Thereupon he opened an extensive shop at Newark, and entered upon a period of experimentation and invention. Here he toiled arduously by day and by night, having upon his hands at one time, it is said, no less than forty-five different inventions and improvements in process of development. The constant strain thus put upon him overtaxed his strength. He gave up manufacturing altogether, and in 1876 removed to Menlo Park, where he built and equipped an experimental laboratory, and devoted himself entirely to investigation. From this laboratory most of the inventions have issued which have made Edison so well known.

Up to the present time, Edison has taken out in this country about four hundred patents, — a fact which shows most clearly the prolific character of his mind. Of these, not far from one-fourth relate to telegraphy, — chemical, au-

tomatic, acoustic, duplex, quadruplex, sextuplex, printing, fire-alarm, district, and domestic; about the same number have reference to electric-lighting; while the remainder refer to the telephone, the electric transmission of power, the electric pen, and other miscellaneous inventions. Among all these, perhaps the most remarkable are the quadruplex telegraph, by which two messages may be sent simultaneously in opposite directions from each end of the line; the automatic telegraph, which can transmit a thousand words a minute; the motograph relay; the carbon telephone; the Edison system of electric-lighting by incandescence; and the Edison electric railway.

Besides his inventive talent, Edison possesses marked ability as an investigator. He discovered independently the variation in resistance produced in semi-conductors by pressure; utilizing afterward this fact in the construction of his transmitting telephone, his tasimeter, and his telephone relay. He first observed the curious fact that the passage of an electric current between a metallic and a moist semi-conducting surface varies the friction between these surfaces, — a phenomenon supposed at first to be electrolytic, though now believed to be electro-capillary. This fact he at once applied to practical use in the motograph relay and the loud-speaking telephone. While experimenting with platinum for the purposes of electric-lighting, he observed that this metal occluded an enormous amount of gas, and noted the remarkable fact that the fusing-point of the metal rose as this gas was expelled; so that a platinum coil, after long-continued treatment at a high temperature in a vacuum, could be made to give many times as much light as a coil of the untreated metal. Hence he propounded the theory that the annealing process consists in the expulsion of the occluded gases by heat, thus leaving the metal more or less porous, and therefore soft and flexible. The various phenomena which he has observed in his incandescent lamps are of great scientific interest. In the first place, these lamps are of exceptional efficiency as condensers. In the second, the Crookes effect is very marked in them, and is equally curious, whether we explain it on Edlund's assumption that a vacuum is a conductor, or on the more probable hypothesis of Rowland, electrical transference by convection. More surprising still, perhaps, is the fact of the ready passage of the current through the glass of these lamps, as proved by him, even at the base, where the glass is not heated.

Of all his discoveries, however, that of the phonograph has undoubtedly given him the widest general reputation. The extreme simplicity of the apparatus by which the tones of the human voice could be recorded, and afterwards faithfully reproduced, excited great interest, not only among the masses, but also in scientific circles, since it promised to be a valuable instrument for the investigation of articulate speech. His latest contribution to science, a photometer containing an accurate standard of light, bids fair to add equally to his well-earned reputation. These facts, among others that might be mentioned, are quite sufficient to show Edison's acuteness as an original observer, and to establish his capability in the direction of independent research. It is much to be regretted that want of time, and a decided distaste for the manual labor of putting his thoughts upon paper, has prevented him hitherto from placing his discoveries on permanent record.

The exhibit made by Edison in 1881 at the Electrical exhibition in Paris was a most interesting one. On both sides of the ocean he had been severely criticised, and often abused, for views held to be chimerical and absurd. At very considerable trouble and expense, therefore, he prepared an elaborate collection of apparatus illustrating his inventions, including many articles of great historic value, and sent them to Paris, in order, as he said, to prove whether or not he had made original discoveries and inventions. The extreme ingenuity of these devices, the thorough knowledge of scientific principles everywhere shown in them, and the great electrical and mechanical skill evident in their construction, won for him, unsolicited, the most complimentary encomiums, and secured without opposition the highest award within the gift of the jury.

In person, Edison is of medium height, rather stout, and quite informal in manner. His face is clean-shaven; his hair dark, with here and there a tinge of gray; and his eyes brown, deep-set, but sharp and clear. A slight deafness gives him a rather absent, and sometimes listless air, which disappears at once, as soon as he becomes interested in conversation. In his experimentation he is minute and painstaking, noting carefully the phenomena he is investigating, and recording accurately the results. Moreover, he is not only quick to observe facts, but prompt to detect their practical importance, and ready to seize upon such of them as may serve as the basis of an invention. His mode of living is extremely simple. In his manners and way

of life, he is far removed from any thing approaching assumption or conventionality. His disposition is amiable and retiring. He is now in the full vigor of health, and, at the age of thirty-eight, finds himself in possession of a well-earned and solid reputation. Should that long life — which seems to be a legacy in his family — be vouchsafed to him, very much more of discovery and invention may be looked for from him as the result of his maturer thought and larger experience.

THE ELECTRIC RAILWAY IN NEW YORK.

For several years past, the question of running the New-York elevated railroads by electricity has been agitated. This culminated in a meeting held in New-York City on the 18th of November, 1884, at which were present representatives of the Edison, Daft, Field, Siemens, Brush, and Bently-Knight electric railways, and also of the New-York elevated railway. At this, and five subsequent meetings, it was decided to test each system of applying electricity as a motive power for railways upon a certain portion of the elevated road. To pass judgment as to the relative values of the various systems, the following gentlemen were appointed to form a board of arbitrators: Sir William Thomson, Prof. Charles R. Cross, George B. Roberts, James H. Rutter, and Robert Harris. It was, moreover, decided to finish the test, if possible, within ninety days. This time has long since elapsed, and the waiting public have heard no report.

During this time, however, a vast amount of work has been done, and great difficulties surmounted. The great delays have been occasioned by the mechanical application of the electric-motor to the heavy and quickly moving trains. In the various systems to be tested, a third rail will be employed; and the laying of this, combined with its proper insulation, has consumed a vast amount of time.

In spite of all difficulties, the Daft company have completed their preparations, and are ready to start. As in other systems, the electric circuit is made from the dynamo to the central rail, through the collector to the motor, thence to the wheels and rails, and back to the dynamo. This company have laid their third rail upon the Ninth-avenue line, commencing at 14th Street. This rail is insulated by the Daft patent insulator, which prevents water from making a connection from rail to sleeper, thus insuring good insulation in all weathers. The road is further equipped by completing the electrical contacts at the joints of the outer rails.

At the end of this line the company have located their central station. They have placed in position a large William Wright engine, with the necessary boilers and shafting. Two fifty-horse-power Daft dynamos are now in position, and, later, a third will be erected to relieve the others, in case of accident. The wires are carried from the station to the rails through the streets upon poles.

The motor, Benjamin Franklin, has been for some weeks finished, and has been thoroughly tested. The motor is fourteen feet six inches long, and six feet nine inches wide, and weighs nine tons. The schematic drawing (fig. 1.) will show the manner in which the motor is arranged. No attempt is made here to reproduce the proportions of the Benjamin Franklin. One of the largest-sized Daft motors *MM*, is mounted upon the truck *FF*. The motor is hung so that it turns about *N* as an axis. The other end is supported by the screw *H*. The maximum capacity of this motor is three hundred ampères, with an electro-motive force of a hundred and eighty-five volts. The power is transmitted from the motor to the wheels by the grooved friction-gearing *P* and *DD*. *P* is keyed to the armature shaft, and *DD* to the drive-wheel shaft. The flange of the drive-wheel, on the farther side, is shown at *W*. These gears are duplicated on the other side of the motor. The amount of pressure upon the friction-gears is regulated by the screw *H*. This screw is also advantageous in case of repairs, for by means of it the motor may be moved completely off its friction bearings. The support *N*, of one end of the motor, is cushioned with heavy strips of rubber, as is also the cap *T*, upon which the screw rests. The trucks are likewise cushioned, thus allowing freedom of motion in any

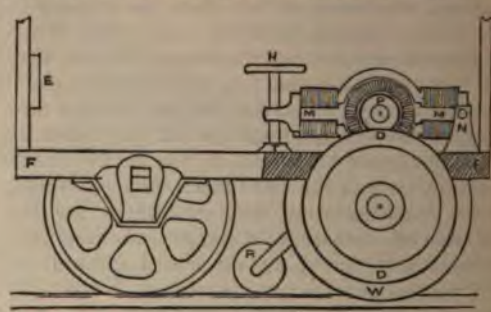


Fig. 1.

direction, and insuring perfect accommodation, on the part of the motor, to any irregularities in the road-bed.

The connection with the middle rail is made by means of a heavy bronze wheel fourteen inches in diameter *R*. This being fastened to an arm, may be raised or lowered, thus allowing discontinuities in the central rail, of which there are several in the Ninth-avenue line, to be safely passed. The wiring is all underneath the frame, and is enclosed in wooden sheathing. The device for controlling the motor is placed at the end of the cab at *E*. This is a device of sliding contacts, worked by a handle similar to the throttle in the locomotive-cab, which raises or lowers the resistance in the field-magnet circuit, thus varying the amount of current, and consequently the strength of field and speed of motor. There is also a complete cut-out in circuit. The motor is thus under complete control, it being possible to run fast or slow. The motor may be stopped either by the cut-out, or by lifting the contact-wheel. The system is further provided with an automatic cut-out, which breaks the circuit when the current reaches a certain strength, at the same time ringing a bell at the central station, warning the engineer at the central station that there is trouble on the road.

The reversing-gear is simply four brushes connected by suitable links, so that a movement in one direction applies one pair of brushes, while a movement in the other applies the opposite pair. In the motor Benjamin Franklin, the ordinary hand-brake will be employed; but later, some form of air or electric brake will be used. This motor is a very substantial affair, as its weight (nine tons) would show. The experiments will be performed as soon as Mr. Daft is at leisure to commence them.

The Edison and Field companies have combined, and are preparing to test their system upon the Second-avenue line. The length of this line from Chatham street to Harlem is 7.44 miles, only part of which, however, will be traversed by the electric railway. Although this company have not brought their work so near completion as the Daft company, still they have done a deal of hard work. They have located their central station upon 24th Street, and have provided there a two hundred and fifty horse-power Whitehill & Smith engine, with the necessary boilers and shafting. The Edison dynamos have not yet been set in position, nor has any wiring been done.

In this system, the central rail has to be very carefully insulated on account of the comparatively high electro-motive force employed (some six hundred volts). To this end, the rails will be insulated by resting upon glass shoes, which will be protected from the jar of passing trains by a thin strip of rubber. As the glass shoes have not been delivered, the rails have not been laid.

The work upon the motor has progressed slowly on account of the many difficulties offered. The original arrangement shown in the *New-York world*, April 26, 1885, has given way to several newer forms suggested by it. The latest form, and the one to be completed, is shown in the schematic drawing (fig. 2).

In this system, every truck will be provided with a motor, thus making every car independ-

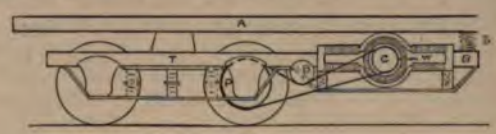


FIG. 2.

ent. In fig. 2, *A* is the bottom of the car, *T* is the ordinary railway truck used upon any car. To apply the motor, the truck is prolonged to *B*, and is supported by the spring *S*. This spring is hung from a roller capable of side motion, thus allowing the truck to accommodate itself to curves. The motor used is a compound-wound Siemens, and is so designed that, with an external electro-motive force of six hundred volts, it will revolve at a constant speed of six hundred revolutions per minute. The power is transmitted from the armature to the pulley *C* by means of a Weston friction-clutch. This friction-clutch *W* is worked by a wheel similar to the ordinary brake-wheel, one wheel working both friction-clutches of one truck. The power is transmitted from the pulley *C* to the pulley *P*, keyed to the axle of the driving-wheels by means of a heavy leather belt of peculiar construction. In order to obtain more bearing-surface for the belt, it is carried around the pulley *B*. This same arrangement is reproduced on the other side of the truck.

The motor itself is movable, so that the tension of the belt may be varied at will. The contact with the middle rail is made by means of brushes sliding upon it. The brushes are mounted on the ends of a bar which prevents their dropping down when another road is passed, and thus short circuiting the track. The brushes are held in position by springs which allow them to turn, and thus insures a drag of the brushes at all times, instead of

a push, thus allowing the joints in the rails to be smoothly passed. The reversing is accomplished as in the Daft, by employing an extra pair of brushes. The speed of the car will be controlled by the friction-brake, the motor running constantly at a uniform speed. The Eames vacuum brake will be employed, the pump of which will be run by the motor.

It will be seen from the above, that the Edison-Field combination are working upon a new principle. This system will have many advantages peculiar to itself. Each car will be independent, and the cars composing the train will start off simultaneously, thus relieving the elevated structure of the great strain caused by the locomotive when starting. The constantly revolving armature, on account of its high speed, and consquently great momentum, will help start the train, thus relieving the engine at the central station of sudden and great strains. As the load on the car increases, the traction likewise increases. The weight, moreover, of a train of this kind, is more evenly distributed than in one moved by a locomotive.

The electric motor, in general, possesses advantages which are of special value on an elevated road. It is possible to balance an electric motor, thus relieving the structure of the constant vibration caused by the quickly-moving locomotive. Its freedom from dust and smoke, as well as its economy, insure its immediate introduction.

Although the progress in introducing the electric motor on the New-York elevated railway has not been so rapid as had been anticipated by enthusiasts, still the progress has been steady, and in the right direction. It is, perhaps, remarkable, that more companies have not commenced operations; but when the magnitude of the task is realized, and the patents held by a few parties are inspected, the reason is seen. However, several other companies intend to commence operations in the immediate future, the plans of which are now maturing.

F. A. Pickernell.

A SCHOOL FOR ELECTRICAL ENGINEERING IN BOSTON.

The wonderfully rapid advances which have been made during the past fifteen years in the technical applications of electricity have taken place at so swift a rate, that the progress of invention has frequently been such as to outstrip the technical knowledge necessary to apply its results successfully and economically on a commercial scale. Within the period mentioned, the arts of quadruplex and multiple telegraphy, telephony, electric lighting on a large scale, and the electrical transmission and distribution of power, have come into being, while an enormous extension has taken place in many of those branches which, like ordinary land and submarine telegraphy, have been practically successful for a longer time. And almost simultaneously with this development of the practical applications of electricity, and largely on account of it, has come a correspondingly rapid and important development in electrical theory, and in the construction of accurate instruments for electrical measurement; so that engineers with an electrical training limited to the small amount which, until recently, was all that could be obtained in our colleges and scientific schools, have found themselves ill prepared to deal with the problems forced upon their consideration. In fact, a new profession, that of electrical engineering, had suddenly opened, and neither the civil nor mechanical engineer was well prepared to pursue it.

Up to the summer of 1882, no adequate provision appears to have been made by our scientific schools for the technical training of young men desiring to enter this profession; but at that time the Massachusetts institute of technology, recognizing the need of such instruction, decided to establish a course leading to a degree in electrical engineering. This course has gradually been brought to a state of completeness, until at the present time, besides a few who have very recently graduated, there are about fifty students who are pursuing it.

The course requires four years for its completion. During the first year the time of the student is occupied with general preparatory studies in mathematics, chemistry, drawing, and the modern languages; and no one is allowed to enter upon any of the professional work of the later years who has not done very creditably in the two first-mentioned studies. The professional work, which extends through the three remaining years, is based upon a thorough study of general physics, mathematics, and mechanical engineering. The theory of electricity, and practice in electrical measurements, are pursued simultaneously in the lecture-room and laboratory, the student learning the use of the different forms of apparatus ordinarily used in electrical testing. A knowledge of the calculus, and of analytical and applied mechanics, is assumed in the professional studies of the course; and works of reference, or, if desirable, text-books written in French and German, are freely used. A very con-

siderable portion of time is given to certain branches of mechanical engineering; so that, by his work in the laboratory of mechanical engineering, the student becomes familiar with the theory and practice of the steam-engine and other motors, and acquires skill in the use of the indicator and the different forms of dynamometer, and also takes part in numerous boiler and engine tests. He thus gains a knowledge, which, in case he enters upon any application of dynamo-electric machinery, will be very important to him.

Throughout the last year an extended course of lectures is given upon the technical applications of electricity, in which the theory and practice of telegraphy, both land and submarine, telephony, electric lighting, and the electrical transmission of power, are discussed. In order to add to the value of this course, the lectures and laboratory exercises given by the regular teachers of the school are supplemented by instruction from various gentlemen who are professionally engaged in the practical development of electrical science, who give courses of lectures, or single lectures, upon special subjects; so that the student has the opportunity of learning exactly what is considered as good practice among those actually employed in the profession which he has chosen.

In any course of this nature, very much depends upon the facilities which are furnished in the way of instruments for precise measurement. The importance of a proper supply of such apparatus has been recognized; and the Rogers laboratory of physics, in which the experimental electrical work is carried on, is well supplied with the necessary facilities. For line-testing, the student has access to actual telegraph-lines, and learns the methods of working most suitable for such purposes. Also an experimental study is made of dynamo-electric machinery, electrical motors, electric illuminating apparatus, and other similar appliances. The student is further required to undertake a certain amount of work of an original nature, and is thus stimulated to enter upon scientific research. A well-selected reference library, containing most of the physical and electrical journals, together with the leading works on these subjects, is accessible at all times.

The aim of the course, as a whole, is to give an education in which theory and practice shall go hand in hand. The pupil is taught, that, as science advances, the two become more and more closely allied; so that his professional success will be most probable, if, to as thorough a knowlege of theory as he can acquire in the four years of his undergraduate study, he adds a large amount of practice in the application of his theoretical knowledge to the solution of the problems with which the electrical engineers of the present time are especially concerned. And an attempt, at least, is made to give him such a preliminary training, that he will find himself well furnished with the necessary knowledge to continue his studies by himself, as opportunity may afterwards be furnished, or occasion require.

ELECTRICAL MEASURING INSTRUMENTS.

For the quantitative determination of an electrical current, any one of its effects may be employed, the law of which is known; and the choice of the effect to be utilized in the construction of a measuring instrument will be influenced by different considerations in different cases. The requirements of the practical uses of electricity necessitate, in general, instruments capable of measuring currents of great strength, varying through a wide range. The instruments must unite the characteristics of compactness and portability with simplicity of mechanism and manipulation, thus excluding many of the methods available in the permanent physical laboratory. The devices which have been employed are so various, and the forms of apparatus so manifold, that a mere catalogue of them would reach beyond the proper limits of an article. As they naturally fall into a comparatively small number of groups, however, the leading characters of certain typical forms may be indicated within a moderate compass, and the merits or defects of some of the more prominent pointed out.

The most common and obvious method of measuring an electrical current depends upon the deflection of a magnetic needle by the current itself. The simplest arrangement would be to use a straight vertical wire situated in the meridian of a very short magnetic needle, and at a moderate distance from it. Within certain limits of approximation, the tangent of the angle of deflection is proportional to the current strength. If the distance of the needle from the wire is made variable, an empirical scale can be experimentally formed, from which, in subsequent use, the current strength may at once be known from a single observation of deflection, the horizontal component of the earth's magnetism being supposed invariable, or its variation determined and allowed for in the reduction. In a permanent installation, such a plan would be feasible, and capable of giving useful results. But it involves some practical difficulties, the most prominent of which are the considerable length which must be given to the wire, and the fact that the wires bringing the current to the vertical portion of the circuit would themselves produce a disturbing effect upon the needle, unless particular

dispositions were made to render them inoperative. The chief recommendation of this method is, that its mechanical execution is so extremely simple as to be within the reach of even an unskilled mechanician. Of course this contrivance entirely fails to meet the requisite of portability.

If the conducting circuit is bent into a circle, and the needle placed at its centre, we have the tangent galvanometer, which may be regarded as the fundamental type among electrical measuring instruments. As in this case, the tangent of the angle of deflection is proportional to the current strength; with a great increase in the magnitude of the latter, the angle becomes too large for accurate measurement, owing to the rapid variation of the tangent for large angles. This difficulty can be obviated by increasing the radius of the circle; but the instrument then becomes gigantic and unwieldy, and is no longer portable. Increasing the strength of the magnetic field is another remedy; and another still is found in increasing the distance of the needle from the circle upon a scale calculated from the theory of the instrument, and verified or corrected experimentally.

The last two devices are employed in Thomson's current galvanometer and potential galvanometer. In these, the coil is made of comparatively small dimensions, as is the whole instrument, rendering it very portable and convenient to use. A semicircular magnet placed over the coil gives a very intense magnetic field, diminishing the deflection of the needle to a suitable value when powerful currents are used; while the compass-box can be moved away from the coil along a graduated scale. These arrangements give the instruments great range in their indications; but as the intensity of the curved magnet is easily affected, they require constant verification. In a laboratory this is very easy, and the apparatus is admirably suited for a variety of applications; but its delicacy, and the need of constant oversight, render it unsuited for rougher work.

Various other methods may be resorted to for increasing the range of the tangent galvanometer. Shunting is a practical and useful device, if care is taken that the shunt is so placed, or so far removed, as not by itself to deflect the needle, or affect the intensity of its field. The current may be passed through another parallel circuit of smaller radius, so that only a differential effect is produced upon the needle by the two portions of the circuit, as has been done by Brackett. Or the coil may be made to turn about a horizontal axis, as in the cosine galvanometer of Trowbridge, re-invented later by Obach.

As in all these instruments, the effect upon the needle is dependent upon the intensity of the magnetic field; and this is usually that of the horizontal component of the terrestrial magnetism: the variation in this may occasion considerable errors unless its value is constantly and accurately known; and there is also the liability to the intrusion of foreign magnetic forces from the circuits and magnetic masses in the neighborhood, a cause of error which is by no means imaginary in practical cases.

A second class of instruments dispenses with the needle, and utilizes the action of a fixed circuit upon a movable one, which is traversed either by the main current, or a shunted portion of it, or an independent current which can be varied or controlled. One of the simplest forms consists of two circular parallel circuits, either single, or consisting of many turns, one of these circuits being freely movable. The strength of the current is then directly proportional to the force required to keep the circuits at a fixed distance apart. This has the important advantages of entirely avoiding the use of magnets, and of equal applicability to steady, variable, or alternating currents. While disturbing magnetic effects are not entirely excluded, they are not usually of serious import. No practical and compendious apparatus embodying this principle is in general use, though it has been employed with success in Hill's dynamometer. Further experiment in this direction seems desirable. The various forms of dynamometer in use generally have the movable circuit mounted, so as to turn about a vertical axis, like the needle of a galvanometer, the strength of the current being computed from the angle of deflection, or read from an empirical graduation. In Siemens's form, however, the movable coil is brought into a fixed relation to the stationary one, by torsion, the amount of which measures the force exerted by the current. But this necessitates constant manual control, and fails to meet one important requirement in such instruments, — that they shall give their indications both directly and continuously.

Another mode of avoiding the use of a magnetic needle, is illustrated by those instruments which employ the pulling action of a helical current upon a rod of soft iron in its axis; and of these there are very many forms. The volt-metre and ampère-metre of Kohlrausch have the core in the form of a thin tube of soft iron for lightness, suspended by a rather delicate spiral spring of many turns, similar to those used in Jolly's specific-gravity balance. The iron tube is closed at the top, and hangs over a cylinder of non-magnetic material, which is fixed in the axis of the coil, and is of such a size as to leave a narrow annular space between it and the iron. The air confined within the tube thus acts like the liquid in a dash-pot, but more freely, and damps the vibrations of the tube and spring very effectually. An index attached to the side of the iron tube moves in front of a vertical scale, one side of which is graduated experimentally to volts or ampères, the other in millimetres. The zero-point is readily adjusted by means of a sliding-rod and set-screw, from which the spiral spring is hung. The two instruments differ merely in the winding of the coils, the volt-metre having many turns of fine wire, with a very high resistance; while the coil of the ampère-metre has a few turns of very large wire, which has a resistance of but a small fraction of an ohm.

In the instruments of Ayrton and Perry, the same mechanical action of the current is used; but the indicator is novel, and very ingeniously uses the axial twist, developed by longitudinal traction in a helix formed from a ribbon of highly-elastic material. A pointer attached to the end of the helix, or to a rod

moves radially over a disk upon which is tion. The disk can be turned through a for the adjustment of the zero. The instru- very compact, simple, and strong, and enient in use; but the spring seems some- e likely to change than the simple spiral ohlrausch.

of the spring, Hopkins has proposed to use onfined in a capsule, the bottom of which by an elastic diaphragm, upon which the exerts a pull when the current passes. The filled with mercury, as is also a portion of glass tube inserted into it. The stress ex- the bottom of the capsule causes the mer- l in the tube, which may be provided with dicating current strength in the customary arious forms of apparatus recently de- volve the same or similar principles, using d floating in a cylinder partly filled with and an index-tube in which the mercury lisplaced by the iron core, or having in the a lighter liquid for the purpose of increas- nge.

rely novel device has been employed by . A horizontal tube, bent upward at the and partially filled with mercury, is placed he poles of a strong magnet. By means of g-wires, the current is conveyed through ry in a vertical direction, at a point in the veen the poles of the magnet. The mer- ersed by the current under the action of the subject to a force which tends to move it thus changing the level in the two vertical n amount which is proportional to the in- the current. As the sensibility requires quicksilver column where traversed by the ould be very thin, this portion of the tube e form of a flat chamber only a fraction of re in thickness. If used for strong currents, g of the mercury would take place rapidly, serious inconvenience. To avoid this cessitate making the apparatus in much nensions, with a loss of sensitiveness, or range.

ation of the plane of polarization of a ray of r the influence of an electrical current has osed as a means of measuring the current. nts, by a number of physicists, have shown urements may be made with considerable n this way; but as they all depend upon the tion of a plane of polarization, the device o be less convenient in its application than hods.

y notice in passing Cardew's volt-metre, in current is measured by the extension of a ed by it, an idea, which, though not new, applied to form a practical and useful in-

e instruments in which the current to be produces motion of a needle, or of a portion uit, the action of external magnetic forces, f the earth, or of the machinery and cir- has already been noted, would be felt as soon as the sensitiveness of the instrument is pushed to the point required for great accuracy, and would make special provisions and precautions necessary. The spring instruments, as they utilize not the directive, but the attractive or repulsive action of the circuit, are almost entirely free from such disturbance, and are therefore better suited for those cases where time cannot be given to preliminary experiments for adjustment, and the determination of constants, or where it is desired to follow the changes of a rapidly varying current. It must be noted, moreever, as has been recently pointed out by Hospitalier, that where the changes in the current occur too rapidly, and especially in the case of intermittent or alternating currents, the self-induction in the coils of these instruments may give rise to considerable errors in their indications; and also that in all those cases where the effect to be measured depends upon the square of the current strength, instruments acting upon the principle of the dynamometer must be used to obtain trustworthy results.

ARTHUR W. WRIGHT.

INCANDESCENT LAMPS ON RAILWAYS.

FOR several months past, the Pennsylvania railroad company have been lighting nine of their cars with incandescent electric lamps. The electricity is produced by Brush storage batteries, which are charged once a week. The storage battery is carried underneath the cars in boxes built to receive them, — one-half being placed on each side. Each car requires six trays of four cells each. The trays are made so that the simple process of putting the trays in position completes the electric circuit. The battery when charged has an electro-motive force of forty-five volts; and, when the electro-motive force has fallen to thirty-nine volts, the battery is recharged. The batteries are charged at the depot in Jersey City by a sixteen-light Brush machine. In charging, the ordinary Brush manipulator, without the register, is employed.

Swan lamps consuming 1.1 ampères have been used almost exclusively, although Stanley-Thomson's lamps have been tried. The parlor-cars require ten sixteen-candle-power lamps, while the passenger-cars require but six. The lamps are all in parallel circuit, and so arranged that one-half may be used at a time. The wires are led through a clock mechanism, which registers the time they have been used. By an ingenious mechanical device, the clock is made to move half as fast when the switch throwing off half the lamps is turned.

Altogether, some seventeen batteries, of twenty-four cells each, are in use; and, as yet, only one cell has been disabled. As to loss of efficiency, due to deterioration, no tests have been made. Although the lamps are probably much less than sixteen-candle power, it is probable that their life is less than that of those used in buildings, because of the jarring to which they are subjected.

fore now recommended, in circular No. 5, an investigation of possible thought-transference in case of the ideas of geometrical forms, the first set of experiments reported on in appendix B having especially dealt with conceptions of number and color.

'Results,' we say, the sensation-seeking public cannot just yet find. But then the word 'results,' as we here quote it, is not identical in meaning with what science usually calls results. For many people, psychical research is nothing, unless it finds wonders; and by 'results' such people mean something to marvel at. But psychology is *not* concerned to find marvels; and the negative outcome of these experiments, as thus far developed, is neither disappointing nor fruitless. The existence of thought-transference of some sort has, indeed, so far been neither proved nor disproved by the work of the society. And, as was known at the outset, the range within which thought-transference can noticeably operate, has long been shown by the practical tests of daily business and social life to be at least a decidedly limited range; since, as a fact, we find it constantly possible to keep important secrets of all common sorts from curious intruders by the simple device of strict silence concerning them. Yet even the negative answer of the experiments is, so far as it goes, already a valuable answer; and, most important of all, the lines of experiment now begun already promise to prove frutiful beyond the range of the direct discussion of thought-transference.

As is shown in the report on the answers to circular No. 4, the effort to discover the existence of thought-transference in case of the number-concepts has led to the observation of certain tendencies in the mind of at least one 'percipient,' to follow certain systems of association in giving his numbers. Minute as seems at first sight the importance of such observations, it is out of just such facts that fruitful generalizations have grown elsewhere in the sciences of experience; and so it may be here. In fact, if we may venture a guess as to the future, it would be the very presumptuous conjecture, that the society may find its search for thought-transference, and for other phenomena of the mental El Dorado, as that region is now popularly conceived, a search in the end somewhat like the well-known quest upon which Saul went, just before he found his kingdom. In short, — guesses about the future results aside, — there is so much to be done for the theoretical and practical needs of psychology, so much experimental research necessary for the formation of a science that may yet have vast influence upon the art of edu upon the treatment of the insane, an the policy of society towards criminals, experimental beginnings of such a sci any direction must be greeted with s tion. If thought-transference is in any region a fact, we shall rejoice to find i if these investigations render it less p rather than more so, they are still certa der their present, cautious, and yet liberal management, to lead to other l logical discoveries that will be worth fa very possibly, than the ones first Let us hope that the members and the will recognize more and more, as time g the wisdom that led the earliest found the society to define its object broadly a systematic study of the laws of mental a In this programme there is no sign of scientific limitation of work to the 'unco or 'marvellous,' or 'little recognized nomena of mind; although these too one meets with them, are to be cordial comed. But the society simply starts do scientific work without prejudice, ar scientific co-operation and patience. Th number is of course confined in its ra work; but the co-operation is well show the patience in the discussion of the le citing details is noteworthy and deeply i tive.

In addition to the mentioned papers, in appendix C a discussion of the "Pos of errors in scientific researches, d thought-transference," by Prof. E. C. ing. This paper treats of a test offered systematic observations on the magnitu the stars, for determining the existe non-existence of thought-transference b the recorder and the observer. The re the special application of this method to vations made at Cambridge, is, for the p negative; but further application is pro The whole pamphlet is unassuming, written, and, to any sober student, help

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ATLAS OF PLANT-DISEASES

The first number of this work, by Dr mermann, consists of two folio plates thirty micro-photographs of different sta three common species of Puccinia, t with a short notice of fungi, as the ca diseases on plants, with special refere the Uredineae. The text is well adapte

Atlas der pflanzenkrankheiten welche durch pi gerufen werden. By Dr. O. E. R. Zimmermann. Ila

The ... Verein für Erdkunde ... for 1884 is largely devoted to ... Hackwitz has an anthropological article ... by an interesting chart of the distribution ... antiquities, customs, boundaries of dialect, etc.; ... a discussion on the orohydrography of the ... Thuringian basin; Edler discourses on sun ... and David Brauns furnishes an interesting ... on the distribution of vertebrates in Japan.

The Argentine expeditions into Patagonia have ... the credit of that country, which has long ... supposed arid and sterile. The report of Gen ... Jas, and that of Col. Roa who has travelled ... than five hundred leagues in Patagonia, affirm ... the region near the base of the mountains is rich, ... ly in metals and minerals, but in fertile ...

... Parties proceeding ... planet, Richard Becker ... many. He died at ... fatigue, on the ... in southern Africa ... Upamba, recently ... After the death of ... go on alone to the ... obliged finally to ... received from him ... of this year.

tary station on the Bahr-el-Jebel. The travellers were engaged in exploring the Nyam-Nyam district, between the tributaries of the Nile and the Upper Kongo. Nothing had been heard of them for a long time, and it was feared that the Mahdi had cut off their retreat.

— The exhibition of metal-work at Nuremberg was opened on the 15th of June. The Japanese exhibits arrived late, in over fifty packing-cases.

— A new exhibition was opened in Paris July 26: it is called the Exhibition of industry, and presents some analogy to the English inventions. It will remain open till the 23d of November. It is to be held at the Palais de l'industrie; and, naturally, electrical matters will be of primary interest. The commissioner-general of the undertaking is Mr. de Redon; and the committee includes some well-known names, such as those of Lemonnier, Tarraut, Milde, Boistel, de Meritens, Cance, etc. Electricians, in fact, form a considerable majority.

— *Nature* states that the third session of the International geological congress, which was postponed last year on account of the cholera on the continent, is fixed to be held this year on Sept. 28, at Berlin, under the honorary presidency of the veteran geologist of Rhineland, Dr. H. von Dechen. The president of the organizing committee is Professor Beyrich; and the general secretary, M. Hauchecorne, 44, Invalidenstrasse, Berlin.

— The New-York *Evening post* publishes the following: I just learn from a newspaper that the commission which investigated the Coast-survey reflected upon me in their report as follows: "That for several years, beginning in 1873, C. S. Peirce, assistant, has been making experimental researches with pendulums, without restriction or limitation as to times and places; that since 1879, expenditures on account of those experiments, aside from salaries of chiefs and assistants, amount to about $31,000; that the meagre value of those experiments to the bureau have been substantially destroyed." I have immediately addressed a letter to the secretary of the treasury, of which the following is the substance: 1°. My expenditures, aside from compensation of myself and my assistants, during the period specified, have not amounted to one-third of the sum named; and I appeal to the secretary to ascertain this by the addition of the amounts of my original accounts now on file in the department. 2°. All my operations have been carried on under specific instructions, and therefore have not been "without restriction or limitation as to times and places." I ask to be informed what operation does not appear to be covered by instructions on file in the office, and promise to show, in any instance, that it really is so covered. 3°. No records have been destroyed. 4°. I maintain the value of determinations of gravity in general, and the excellence of mine in particular. 5°. I tender my resignation if the opinion expressed as to the meagre value of my services is accepted by the department. Until my letter is acted upon, it might perhaps be considered a breach of official etiquette for me to make it public; but I wish you, as a friend and scientific man, to know that I have a defence against the accusations made. C. S. Peirce.

Ann Arbor, Mich., Aug. 10.

— The *Romaji zasshi* is a journal recently established in Japan, with the object of introducing the use of the Roman alphabet to spell phonetically the Japanese words. The journal is partially supported by the government, and is the official organ of a society of some forty-two hundred members, which aims to do away with the Chinese characters in Japanese literature.

— A late report upon the Cambridge (Eng.) local lectures, by Mr. Roberts, contains (says the London *Graphic*) an interesting story of the pursuit of scientific knowledge under difficulties. Two miners at Backworth, in Northumberland, in order to attend a course of lectures on chemistry at Cramlington, five miles off, walked after their day's work to that place and back in order to attend every lecture. They made sufficient notes to enable them on each occasion to retail what they had heard to a class formed by them at Backworth, and actually repeated the experiments, so far as rough apparatus and their means would allow. The lecturer visited this little class (there were only seven in all), and found upon examining them that they had acquired a sound knowledge of the first steps in chemistry. This germ has now blossomed into 'The Backworth students' association,' consisting entirely of miners. It is not often that such a splendid instance of self-help is offered for our admiration, and, we may add, imitation.

— The death of the distinguished zoölogist, Henri Milne-Edwards, so long connected with the Paris museum, is announced to have occurred on July 29 last. He was a Belgian by birth, and spoke English fluently. His son Alphonse has been, in recent years, almost as well known, his father's age (he was born in 1800) preventing much literary activity.

— We learn from *Nature*, that, on July 10, at about noon, a wonderful mirage was seen on Lake Wettern, in Sweden, by a number of people between the villages of Fogelsta and Vadstena. A small island in the lake appeared as if covered with the most gorgeous flora, and tall gigantic trees, forming great groves, between which buildings having the appearance of the most splendid palaces were seen. The Sandö, another little island, seemed to rise out of the sea many times its actual height, its sandy shores looking like lofty castellated walls. It had the exact appearance of a mediaeval fortress enclosed by four walls. Two other little islands, Åholmen and Risön, appeared also as lofty towers above the water. The mirage lasted for nearly half an hour, when it disappeared somewhat rapidly.

— Inspired, apparently, by the success of Marvin's 'Russians at the gates of Herat,' Mr. Archibald Ross Colquhoun — the author of 'Across Chrysē,' and special correspondent of the London *Times* in China — has written a little book of fifty-eight pages on Bur-

urmans, or 'The best unopened market
' (London: Field & Tuer). The late
Mandelay, the capital of independent
drawn public attention to that part of
ich the recent actions of the French
nd southern China have not tended to
bly no one is better qualified by actual
or his task than Mr. Colquhoun; and
essay, with its map and statistical table,
e the careful consideration of all who
in what may at any day become the
rn question.

-Arbor meeting of the American asso-
Aug. 25, and closes Sept. 1, not Sept.
sly stated in some of the circulars.

ial association train will leave Buffalo
ug. 25, will stop three hours at Niagara
ve in Ann Arbor at 8.23 P.M.

burg railroad requests us to announce
Ann Arbor and return, by the Hoosac-
ill be sold at reduced rates.

uaire géologique universel et guide du
e title of a projected annual, of which
ne has lately been received. It is edited
court of the 'Comptoir géologique de
ontains articles on a number of differ-
by competent geologists. The chief
work, as stated in the preface, is to give
eologists of various countries, so as to
range of professional acquaintance; to
e tourist the principal collections and
he should visit, and to record the an-
of each nation. Only three months of
ave been spent on the first volume; its
aving been hurried, that it might appear
eting of the geological congress at Ber-
aber, and that it might give rise to criti-
hich the editor hopes to profit. The
s collected embrace brief geological
everal countries, North America being
Margerie of Paris; accounts of official
lications, and maps; lists of societies
logists, and of universities and muse-
n recent geological works. This pro-
no means uniformly carried out: uni-
ecution would be a manifest improve-
rinting is not done with sufficient care;
t of addresses, the errors are seriously

ent L. Wragge is arranging, says *Na-*
tablishment of a meteorological station
ueensland and New Guinea. He hopes
n observing station at Port Moresby.
will carry on the work of the Torrens
Mr. Wragge is also arranging for the
f his observatory on Mount Lofty.

ortant papers have lately appeared on
orona around the sun, — one by Kiess-
urg, who has already given the best
the optical process by which the ring is
other by Forel of Morges, Switzerland,
sted that the corona be called 'Bishop's ring,' after its earliest observer, the Rev. Sereno F. Bishop of Honolulu, who noted it on Sept. 5, 1883. The recent papers are concerned with the extension of the area of first visibility; and both writers conclude that there is no question of the connection of the ring with the famous sunsets, or of the origin of both of these remarkable phenomena in the dust thrown out from Krakatoa. Kiessling quotes with approval the name suggested by Arcimis of Madrid, 'Corona solar krakatoense.' The need of observations, especially at elevated stations, to determine the duration of the ring's appearance, is emphasized. Mount Washington and Pike's Peak should afford good records.

— On Tuesday morning, July 14, an earthquake occurred in eastern and central Bengal which, according to *Nature*, is said to have been the severest one experienced by the inhabitants for forty years. The shocks lasted for nearly a minute. In Calcutta, the houses rocked and cracked, and the plaster fell in large quantities. There was general consternation, the people all rushing out of doors. A wave was raised in the river like a bore, causing some anxiety with respect to the shipping. Luckily no accident occurred, and no damage was done beyond the cracking of the walls of some old houses; but, had the shocks lasted some seconds longer, the city would probably have been laid in ruins. Some of the up-country stations were less fortunate. At Serajgunge, a chimney belonging to some jute-mills fell. In many other places some of the houses fell, and people were killed. Twenty-five deaths are reported to have occurred at Aheripore, five at Bogara, eleven at Azimgunge, and several at Dacca. The following morning another shock was felt in Cashmere, which did some injury. According to the latest reports, the earthquake caused altogether seventy deaths in Bengal.

— Tuttle's comet of 1858 was seen at Nice on Aug. 9. Johannes Rahts, a german computer, has calculated an orbit from the observations made at the 1858 and 1871–72 appearances, with the perturbations of the principal planets included. His ephemeris agrees with the place in which the comet was found within fifteen seconds of time, and about six minutes of arc; so that, by pointing the telescope to the computed place, the comet would be in the field of view after an absence of nearly fourteen years. Using his elements, the perihelion distance of the comet is ninety-five million miles, and the aphelion distance nine hundred and sixty-seven million, the period being 13.76 years. According to these data, the comet, at its nearest approach to the sun, is at about the same distance as the earth, and, at its farthest distance, it is about a hundred million miles beyond the orbit of Saturn. It will slowly approach the earth and its light increase during the present month, its distance at time of discovery being a hundred and seventy-five million miles. It will not, however, become visible to the naked eye. This is one of five comets discovered by Mr. H. P. Tuttle at Harvard college observatory, two others besides this having been discovered in 1858.

— *Nature*, for Aug. 6, in its leading article, quotes with approval, and re-enforces with new arguments, the claim which *Science* made last February, that great saving could be effected upon the introduction of prime-meridian time suggested by the Washington conference, by the virtual amalgamation of the nautical almanacs now published separately by each of the maritime nations, and commends our suggestion that the money thus saved should be expended upon an international mountain observatory. The same number contains a long article on the coordination of the scientific bureaus of our government, based upon the two schemes proposed by the committee of the national academy, and by Major Powell, which appeared some time since in *Science*. The article on the Lick observatory, which we published last June, is also given in full. We shall shortly print another, with illustrations.

— Another exhibition, to be held in New Orleans, is proposed for next winter.

— A short time before his death, Prof. H. R. Göppert of Breslau, in connection with the chemist Professor Poleck, made a study of the Hausschwamm, — a fungus commonly known with us as dry-rot, which had caused great injury to buildings in northern Germany. The results of their combined studies now appear in a pamphlet by Professor Poleck (Der hausschwamm, Breslau, 1885). The dry-rot, Merulius lacrimans, seems to be unknown in a wild state in Germany, but is confined to wood-work of different kinds, and attacks by preference, coniferous timber. Strange to say, the fungus does not usually infest old structures, but generally makes its appearance in comparatively new buildings; and a startling series of figures shows the amount of damage done in the region of Breslau. Chemical analyses by Poleck show that the merulius is particularly rich in nitrogenous compounds and fat, which is rather remarkable, when one considers the chemical constituents of the timber on which it grows. Injury to health, or even death, is said to result from exposure to air containing large quantities of the spores of the merulius; and several authenticated cases are reported. In a supplementary note, Poleck considers the relationship of merulius to actinomyces, a fungus which causes a characteristic disease in man and cattle; and he apparently comes to the conclusion that what is called actinomyces is probably only the merulius altered by the peculiar matrix on which it is growing. His statements on this point can hardly be called conclusive, or, in fact, other than vague.

— An interesting new limuloid crustacean from the Upper Chemung of Erie county, Penn., is described in the *American journal of science*, under the provisional generic name of Prestwichia. It occurs at the junction between a bluish sandstone and a soft fine shale, which, in the process of weathering, has worn away, leaving a sharply defined cast in hard sandstone.

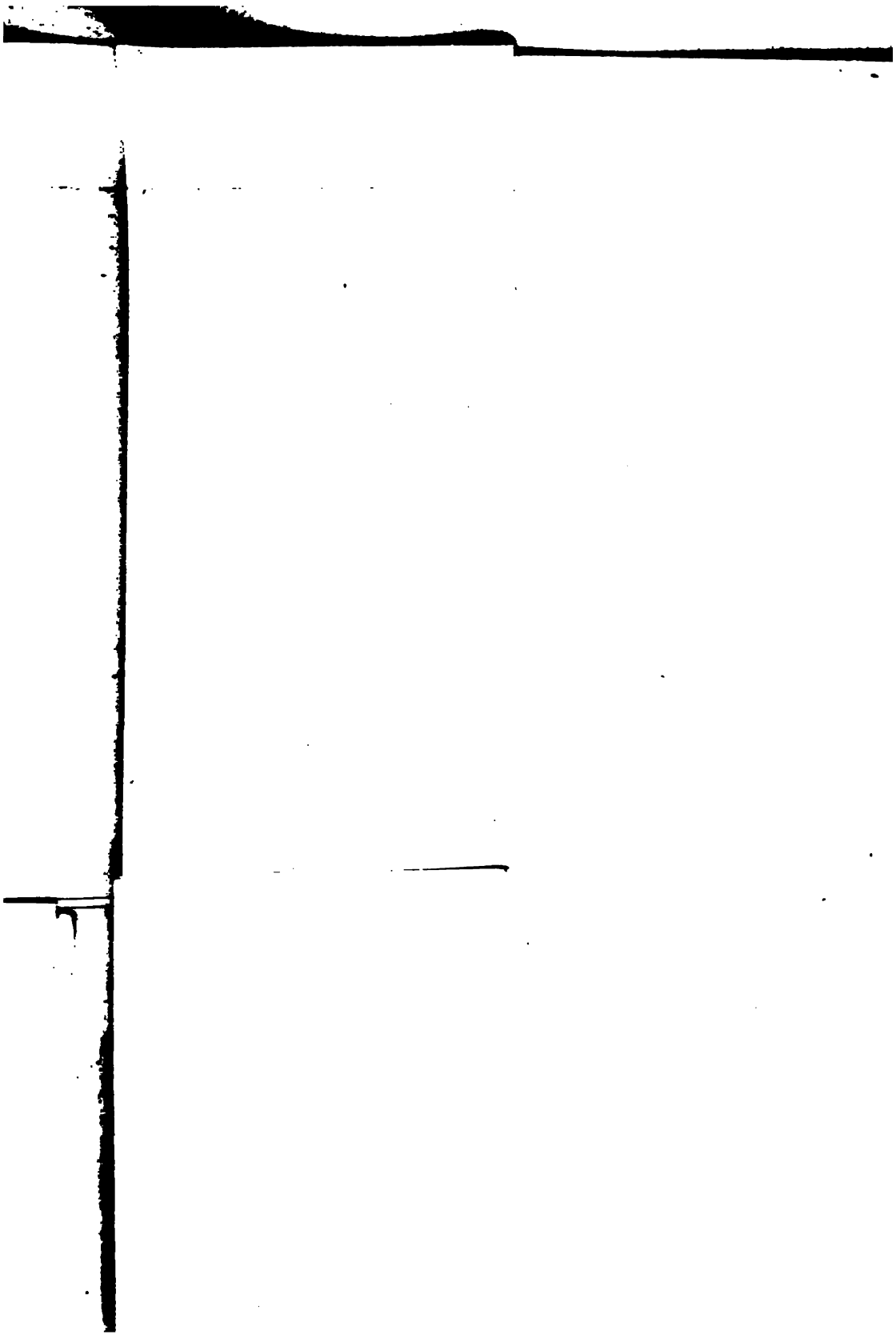
— In Vallorbes, in Switzerland, there are several important fish-cultural stations for the development of trout, the chief of which are on the borders of Lake Neuchâtel. From 1864 to 1870 the s Poissine has placed in the neighborhood o young fry in the rivers, and from 1872 dow present time more than 1,000,000. By th the rivers have been restocked in a very sat manner, and the trout of Vallorbes are fa This total would have been much larger ha possible to secure the required number of 1885, 74,000 fry were developed; the eg placed in the incubating cans from the 10 20th of April, and in the stream, between and 31st of May, according to the rapidity of ment.

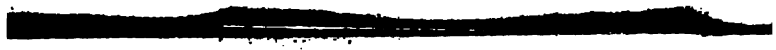
— The industry of gutta-percha productio has been so profoundly menaced by the vast tion of the trees by the natives, is likely to b increased in importance by the discovery Edward Heckel, recently published in *Lo* Dr. Heckel has announced that there is a tr tral Africa, Butyrospermum Parkii, called natives 'karité' or 'caré,' which is likely to re gutta tree. The berries of this tree produce wax called 'butter of karité,' and valued h the natives and travellers. The tree covers tropical area of central Africa in dense fore after it has attained the age of four years, sible by discrete incision to obtain from its t larger branches an annual supply of four kilo of gutta ($5–6 per year at the present price) injuring the tree in the least. By reason of facility with which this tree grows in all soil, and because of the success attending tivation in a few places, Mr. Heckel think can be profitably transplanted into the Eng French colonies. Guided by botanical an also suggests it as highly probable that the species of Bassia will give a product similar of the karité of Africa.

— By a congratulatory letter addressed to the society upon the occasion, Professor A was recently reminded that fifty years have since he was elected a member of the oldest history society in Germany, the imperial A leopoldino-carolina naturae curiosorum.

— Dr. A. W. Ljungman has been granted Swedish government the sum of 350*l.*, in ad his salary, for investigating the herring and ring fishery on the south-west coast of Swed

— The twelfth number of the German *zeitung* contains an article by Herman So experimental cultivation in tropical Afri maintains that the soil is suitable for agri though it is exhausted in a year by the cul of maize and manise: he recommends the cul of coffee, vanilla, India rubber, tobacco, cot sugar-cane according to the varieties of soil. de Gile, commander of the Upper Kongo has published a most enthusiastic descriptio country, where nearly all the above-mentione and many others, grow naturally, or are alre tivated. He represents the climate as healt the country thickly populated.





SCIENCE.

'RIDAY, AUGUST 28, 1885.

HICAL SKETCH OF THE PRESI-T OF THE ASSOCIATION.

OR HUBERT ANSON NEWTON, who is ent of the American association for ement of science, has held the chair natics in Yale College since 1856. he has had charge of the instructions nch of New e 1853, college ed, by he ser- ofessor He had n his duate trong tow- ematic- ; and ntment orship, after tion in 1850, y con- e pre- and im the hich he

stinction at home and abroad.

ard life has been uneventful. From ien he entered college, almost forty he has remained in New Haven, devoted to the work of his pro- Occasional visits to Europe have n into personal relations with the ians and the institutions of other Academic honors, as little sought e well deserved, have fallen upon him. He was made an associate editor, many years ago, of the *American journal of science*, in whose pages his principal memoirs have appeared; he has been a vice-president in the scientific association of which he is now the head; he was one of the original members of the National academy of sciences. In the Winchester observatory of Yale college, he is a leading manager. The University of Michigan conferred upon him, in 1868, the degree of doctor of laws.

But he has still stronger claims than these to that recognition which his scientific friends have bestowed by inviting him to preside over their meeting at Ann Arbor. It is as an astronomer that he has won his highest reputation; and, as an astronomer, his name is forever to be associated with the discovery and enunciation of the laws of meteoric showers, so mysterious when he applied his mind to their investigation, so comprehensible now.

Professor Newton came into the field of meteors by what might be called an official inheritance. While he was an undergraduate, Denison Olmsted, his teacher in astronomy, with Alexander C. Twining, Edward C. Herrick, and others whom they had enlisted, were intent upon understanding the phenomena of shooting-stars. The resplendent shower of

Nov. 13, 1833, had aroused the imagination and the determination of these keen observers, and they were constantly engaged in meteoric discussions. The enormous Texan aerolite, preserved in the college cabinet, was an imperishable wonder. The Weston meteor had been described, long before, by Silliman and Kingsley. Even in the previous century, Thomas Clap, the rector of the college, had published a tract upon meteors, interesting now as an embodiment of what was then known and thought. These were precursors of the investigations in which Newton was destined to become a leader. The story of this period may easily be gathered from an article (which appeared in the *New Englander* for 1868) by a writer qualified in all respects to prepare the narrative, Prof. C. S. Lyman.

Without going over the ground there traversed, we shall follow Professor Lyman in saying that the cosmical origin of the November meteors, and the true explanation of the radiant, as well as of its position with respect to the earth's orbit, had been well settled by the observations of Olmsted and Twining after the shower of 1833. Olmsted had attempted, but unsuccessfully, to point out the probable orbit of the meteors in space. Newton first took sure and definite steps toward such a determination. He collected and analyzed previous observations, and pointed out not only the five possible orbits, but how the only true one could be determined. The laborious computations necessary were made by the distinguished English astronomer, Professor Adams of Cambridge; and thus the orbit of thirty-three and one-fourth years was definitely established. Newton's papers on this subject in the *American journal of science* have become classical, and are referred to by all writers on meteoric astronomy. His later papers on comets are characterized by the same originality and ability as those on meteors, and have largely added to his scientific reputation. An important memoir from his pen appeared in the first quarto volume published by the National academy of sciences in 1866, wherein he endeavored to show the laws which govern the movement of sporadic meteors, as h had previously investigated the phenomena periodic showers. Two admirable summari of what is known in respect to meteoric la have been contributed by this acknowledg authority to the new edition of the Encycl paedia Britannica (vol. xvi. 1883), and Johnston's Cyclopaedia (1877).

In all matters pertaining to the advanceme of education and the progress of scienc Professor Newton has been a wise and fi upholder of conservative ideas. He has sho no desire for popular applause: he has rar appeared as a speaker before public asse blies. But wherever he has been called upo he has come forward with independence, co age, and persistence, to uphold what he believ to be right. In electing him to be their pr ident, the association has shown its desire honor one whose titles to such a distinct are of the most solid character, — importa contributions to knowledge, by difficult a prolonged study, guided by an acute and we trained mind.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. T writer's name is in all cases required as proof of good faith.*

Man's ancestry.

PERMIT me to dissent from your editorial comme (*Science*, vol. vi., p. 81), that man is of those for whose ancestry is unknown. I cannot but thi that the data at hand are already abundant for answer, and that we can allocate his systematic re tionships as well as those of any other animal. T data are given in the anatomical monographs, better still, can be tested by a comparison of t structure of man, and the primates, as expressed the skeletal and other systems. It is difficult for n to understand how any one acquainted with the da could reach a conclusion other than that man is t derivative of a form very much like the chimpanz and gorilla, and that, could his remote ancestors seen, they would be placed not only in the same famil but in the same group with the African apes. T general agreement in the skeleton, the anapoph ses, the digits, the sternum, the pelvis, the car and tarsal bones, the tuberculation and ridges of t molars, and numerous other points in which the is similarity between man and the African anth poids, appear to me to preclude any other scienti conception. Compare man and the anthropopith of Africa, contrast the several species with the oth apes, and the monkeys generally, and then apply t doctrine of probabilities to the morphological resul The only logical conclusion must be that man

descendant of an ape, which would be only generically separable from the chimpanzee and the gorilla; and that while the last two are little modified descendants from a common stock, man's structure, in some respects, has been much modified, — but even man's deviation is mostly superficial and psychological. THEO. GILL.

Washington, Aug. 5.

[We meant, by the statement which Dr. Gill criticises, that the immediate exact ancestors of man are not known to paleontologists; and that the morphological evidence has not yet been so fully worked over as to afford definite conclusions as to the evolution of man. The elucidation of the exact affinities of man with various primates still awaits exhaustive study: that he is related to the anthropoid apes, is, of course, well established; but that he is more closely related to them than to any other primates has still to be proven. In suggesting a relationship between man and the monkeys, we meant rather to propound a question, than to advocate a conclusion. In reality, there is probably no essential difference between Dr. Gill's opinion, and the suggestion emitted in our comment, which our critic seems not to have understood as we intended. — ED.]

A mad stone.

Your question, Mr. Editor, having regard to Mr. Sampson's letter concerning a 'mad stone,' 'how did such a superstition arise?' admits of a ready answer. Many a porous stone, in good capillary condition, can *suck a wound*, not so effectively, perhaps, as the lips of Queen Eleanor, but still with considerable power. This fact is especially true in case the stone has been moistened so that close contact between it and the body may be secured, as well as continuity of the fluids, and evaporation from the external surface of the stone, to actuate the capillary flow. Familiar applications of the principle are seen when the country-boy puts a dab of mud upon the spot where a hornet has stung him to compose the pain; and when the housewife uses French chalk, or soap-stone dust, or wet plaster-of-Paris, or, better yet, clay moistened with naphtha, ether, or oil of turpentine to draw out a grease-spot from clothing or from the floor. Thus much for the basis of the 'superstition.' It is assuredly easy to conceive withal that 'mad stones' may have existed of such chemical composition, or charged with such chemical substances, that they could act as germicides as well as absorbents. Indeed, we have already in that most sovereign of balms, powdered chalk for a mosquito bite, something so nearly akin to the ideal mad stone, that your correspondent was more than justified in according to the matter his portion of that careful attention which Arago did extol. F. H. STORER.

THE KONGO FREE STATE.

MR. STANLEY has given a history of the planting of this state, its growth to the present time, and the recognition of its flag and sovereignty by the powers of Europe and America, at the Berlin conference. His book has been supplemented by reports from French and Portuguese travellers; from Lieut. Cameron of the English army, who crossed Africa from the east to the west a little below the valley of the Kongo; from Mr. W. H. Tisdel, the agent sent by our government to the Kongo; and from Admiral English, commander of our fleet on the African coast. These reports, though somewhat conflicting, can be reconciled, and the truth ascertained.

The Kongo free state, by the terms of the Berlin convention, controls a narrow strip on the northern banks of the Lower Kongo, from the ocean to Stanley Pool; thence the territory extends north-east to between the fifth and sixth degrees of north latitude, and south below the eleventh degree of south latitude, and east to within a few hundred miles of the Indian Ocean, including in its limits nearly all the water-shed of the Kongo and its branches.

The river is navigable from the ocean to Vivi. Between Stanley Pool and Vivi, 235 miles, there is a fall of 1,200 feet, with 80 miles of navigable water between the falls. There are a large number of navigable branches running into the Kongo, and steam-launches have sailed on the Kongo and these branches nearly 1,500 miles. Mr. Stanley estimates, indeed, that there are over 5,000 miles of uninterrupted navigation on them; and that, in addition, the navigable waters of other tributaries would probably bring the total to about 20,000 miles: these estimates cannot be fully relied upon, but there is sufficient evidence to prove that the navigable waters of the Kongo exceed those of any other river in the world.

The land in the eastern part of the water-shed of the Kongo is between 4,000 and 5,000 feet in height, falling at first pretty rapidly, and then more gradually, into the great valley of the Kongo, about 1,500 feet above the sea-level.

As the river rises in the east, runs to the west near the Equator, its valley has nearly the same climate, growing more temperate towards the sources of the river. The whole area is abundantly supplied with rainfall.

The outlets for the trade of this vast region have hitherto been south through the Portuguese territory to the Atlantic Ocean at Benguela, or else north-west through the French possessions to the valley of the Ogowé. The Kongo offers the shortest route to the ocean, but the river has cut its way through the chains of mountains; while the Kwilu Niadi, in the territory of the association, and the Ogowé, follow natural valleys, and reach the ocean by longer and easier routes.

Mr. Stanley constructed a road around these falls. It crosses a succession of valleys and steep hills, some one thousand feet in height.

In the valleys are streams, lowlands, and swamps; and the lowland is so rich, and the growth so luxuriant, that the grass and cane attain a height of from eight to ten feet in a short time, and completely hide and obstruct the road, so that it is almost impossible to maintain it in a passable condition. As there are no beasts of burden in the country, all goods are carried around the falls on the heads of porters, or pulled up the steep hills.

A small steamer, the Stanley, of thirty tons burden, constructed in sections, arrived at Vivi nearly two years ago. A force was at once organized to move these sections to Stanley Pool; but all efforts have been fruitless, and the different sections now lie rusting in the valleys or on the hills.

Two hundred and fifty thousand dollars are annually paid for porters between Stanley Pool and the coast, by the International association, native traders, and three missions.

The expense of transporting merchandise and stores from the ocean to Stanley Pool, exchanging them for the products of equatorial Africa, and carrying these to the ocean, exceeds the value of the articles when delivered at the stations on the coast. Mr. Stanley admits this fact, and says that "the Kongo Basin is not worth a two-shilling piece in its present state."

The only way in which the products of equatorial Africa can be conveyed from the Kongo to the ocean, is by means of a railroad constructed either down the Kwilu, the Ogowé, or the Kongo. The Kongo railroad will probably cost much more per mile than one by either of the other routes; but, as it is the shortest, the total expense of construction will be less, while the operating expenses will be much less.

Whenever the merchants and bankers of Europe and America are convinced that this road will pay, it will be built, and the settlement and civilization of Africa commenced.

Little difficulty has been found in procuring laborers for the construction of the Panama railroad and canal, and no greater difficulty will be found in the construction of this road.

It therefore becomes necessary to ascertain if the soil is fertile, and yields bountifully the products that are required in temperate regions, and if the climate permits cultivation and trade to be carried on under the supervision of white men.

The steamers of the association have visited many tribes on the banks of the Kongo, establishing stations, and examining the bottom lands of the Kongo and its branches. But they know little of the great valley of the Kongo and its tributaries. It is believed that the soil is generally fertile, though there are probably, both north and south of the river, large lakes and tracts of low and swampy land. But a long time must elapse before equatorial Africa is thoroughly known.

The soil in the valleys is exceedingly rich, and yields all the products of equatorial countries. Cattle are not found; but, as they are raised in large quantities on the eastern part of the water-shed, they can probably be raised in the valley. Ivory, palm-oil, rubber, dye-stuffs, and gums are abundant; and tea, coffee, cotton, pepper, spices, and sugar can be grown to an almost illimitable extent.

A rich and fertile soil is of little value without laborers to till it. These cannot be brought from abroad, but must be found in the country itself. The natives of Africa are naturally improvident, and work only when compelled by the whip of the master, or necessity. They have few wants, require little clothing, the ground yields spontaneously enough for their support, the rivers abound in fish, and the women do all the work.

The early laborers employed by Mr. Stanley were Kurmen from the west coast and Zanzibaris from the east coast; but Mr. Stanley has gradually substituted native labor, and now fifteen hundred natives are on the pay-roll of the association. As the negro is taught the wants of civilized life, he will, by slow degrees, be induced to work; but a long time must elapse before the lands of equatorial Africa are settled and cultivated to any great extent.

It will be impossible to carry on trade with Africa, or civilize the country, without the presence of white men.

The western coast of Africa is the most unhealthy country in the world; and the loss of life at the stations at the mouth of the Kongo, and in the expedition of Capt. Tuckey, seemed to prove that the valley of the Kongo was equally unhealthy. Reports from returned employees of the association, and others, confirm this opinion. They say that a large number of the foreign employees have died, while many others, enfeebled by disease, have returned home.

It is evident, from the account of Mr. Stanley, that there has been a large proportion of deaths and disabilities among the employees of the association; that exposure or intemperance, which in Europe causes only temporary inconvenience, is followed on the Kongo by fever, and often by death, in a very short time. The statistics are insufficient to enable

us to form a correct judgment in regard to the mortality.

Mr. Stanley was unfortunate in the selection of several of the stations, particularly those at Vivi and Stanley Pool. They were located on high ground, and supposed to be peculiarly healthy; but at these stations the hills on the two sides of the river converge, and the cool breezes from the river and the valley blow over the stations as through the mouth of a funnel: and sickness and death are much more frequent than in low stations in the valley of the river protected from the wind by the hills or trees.

Mr. Stanley asserts, and we think he is correct, that when the sanitary conditions are better understood, and the exposures incident to the settlement of a new country overcome, proper food obtained, with temperance in eating and drinking, a man can accomplish as much work in equatorial Africa as in temperate Europe; provided, as stated on another page of *Science*, he returns home every eighteen months for a vacation of three or four months.

The death-rate is always high in new countries. In New England, and in the temperate regions of America, as well as in torrid zones, new settlements are always unhealthy, and great mortality prevails; and not until permanent settlements are made can we pronounce upon the healthiness of any climate. We believe that equatorial Africa, being nearly two thousand feet above the level of the sea, will be less unhealthy than India, or many other countries where white men live, and carry on a large and successful trade.

The association has already planted twenty-two stations up and down the valley of the Kongo, and expect to plant and maintain other stations every fifty or one hundred miles on these waters. The natives within the influence of these settlements are beginning to labor, and bring in their productions to the settlements. A small amount from each station will make a large foreign export, sufficient to support a railroad from Stanley Pool to the ocean.

The stations are now ready, but the merchants cannot successfully establish stores for trading with the natives until the railroad is built. The cost of the railroad is estimated by Mr. Stanley at $5,000,000 in the body of his book, and at $7,500,000 in the appendix.

All that equatorial Africa now requires, is the construction of the railroad from Stanley Pool to Vivi; and we trust and believe that the same good judgment, executive ability, and energy, which have won success for Mr. Stanley's other undertakings, will enable him to raise the funds for this enterprise, open the heart of Africa, and accomplish the objects of the association. GARDINER G. HUBBARD.

COMPOSITE PORTRAITURE.

THE process of composite photography has been applied to the solution of two problems: 1. Given a series of objects having in common an interesting characteristic, to find a single type which shall represent the whole group. 2. Given a series of representations of the same object, to find a single representation which shall give a superior effect by combining the strong points, and neglecting the defects, of each of the series. The latter problem is by far the simpler. The composite of six medallion heads of Alexander the Great may be taken to represent the real Alexander better than any one of the originals, because the probability of the six artists having introduced the same inaccuracy is very small. In the first problem, however, we are introducing an essentially new face, — a type representing *par excellence* the peculiar characteristic for which the originals were grouped together. In combining the portraits of criminals, the object is to get a type of criminality; in combining the portraits of national academicians, one of recognized scientific ability.

Other methods of producing a type are when the artist puts on paper the general effect of more or less unconscious observation of physical peculiarities in the class of persons represented; or when the anthropologist selects among a number of savages, for instance, one who was judged to have all the distinctive marks of his tribe in neither an exaggerated nor a deficient degree, and yet combined with them no individual eccentricities, — in short, that much-talked-of average man, whom one does not meet every day. Composite photography aims to take this process out of the hands of erring judgment and vague imagination, and reduce the art of type-getting to a mechanical one of combining photographs.

In several cases, when various images have been combined to elicit a type, it has happened that the resultant has been remarkably similar to one individual of the group represented. This was strikingly illustrated in the portraits published in *Science*, No. 118. Mr. Galton mentions, that in one such case he took a second composite, omitting the face which resembled the first composite, and the two pictures thus

obtained were practically alike. In the case of the national academicians, the gentleman referred to as representing the type was not one of the sitters at all. The explanation of this peculiarity (excluding all possibility of mechanical error in photographing) seems to be possible in two ways. It may be regarded as an example of what has been spoken of as 'prepotency,' which means that one set of features was so powerful and characteristic as to outweigh the effect of all others not in harmony with it. On the other hand, it may be said that the peculiar face is really very nearly the arithmetical mean in point of appearance of its class. For example, if we desired the average height of twenty-one men, five of whom were five feet ten inches high; five, five feet nine inches high; one, five feet eight inches; five, five feet seven inches, and five, five feet six inches, each, we might take the man of five feet eight inches as the average of the lot. This individual would then be the mean of his class, just as the one face was the mean of its class. If, now, we omit the man of just five feet eight inches in height, the average of the group is not altered in the least. So, also, in omitting the one photograph, as Mr. Galton observes, the type is not altered. This leads probably to the latter explanation.

The problem is reduced to its simplest terms in the combination of but two faces. The resultant here ought to be the exact mean between the two originals. If the composite resembles one more than the other, we must regard that one as the more powerful characteristic face; if it resembles each of the originals, they probably resemble each other; if it differs from both, they differ from each other. That is, the mean of three inches and five inches does not differ much from either, nor do they differ much from each other: the mean of one inch and seven inches is also four inches, but the differences between them and the mean are large.

I have attempted to experiment with ordinary photographs, and without the elaborate apparatus of composite photography, and give my results, in the hope of thus placing the process within the reach of every one.

The most natural method of combining two pictures is by means of the well-known Brewster stereoscope. I tried this, and was surprised at the splendid result. I went to work with all the fervor of an original discoverer, but afterwards found, on looking at Mr. Galton's article, that he had done the same. I mention this, because Mr. Galton himself, in the same place,[1] admits an independent suggestion, both of this and of composite photography, in the shape of a letter from Mr. Austin of New Zealand, to Charles Darwin.

It was easy to arrange a device by which one of the two photographs could be raised or lowered, moved laterally, and also swung around its centre so as to bring its image exactly in correspondence with that of the other photograph. The only requisites are that the two pictures be approximately of the same size and position. When these requisites were not satisfied, I found other methods of combining them, as will appear below. With an ordinary stereoscope and a family album, any one has the means of an amusing and instructive study. A few of the results gotten in this way may be worth recording.

As was said before, in uniting two pictures, say of two sisters that are commonly considered to resemble each other, the composite is very much like either. Some will call it more like the one, some more like the other. By alternately closing each eye, and then opening both, the observation becomes more striking. If the pictures represent persons who are total strangers to each other, the result is often an entirely different face from either. The effect is peculiar of combining the photographs of two persons of opposite sex. The male face seems to predominate; but this is probably due to the influence of the beard, mustache, etc.; for in combining children of opposite sex, or using photographs of adults with smooth faces, the predominance disappears. Like the beard, so, too, the hair, costume, etc., are apt to lend an undesirable peculiarity to the composite. This can be partly avoided by cutting out the shape of the face proper in white paper, and attaching it with a rubber band to the photograph, thus combining the features alone. On the same principle, one can combine the upper part of one face with the lower part of another by covering with paper the suitable parts of each.

One can combine persons of different ages with good result. A young lady of twenty, combined with her mother of sixty, gives a lady of about forty years of age. A still more striking case is, when a girl and her grandmother give as a composite a middle-aged woman much more like her mother than like the girl herself, or her grandmother, although a family resemblance runs through the group.

As Mr. Galton says, the effect is often to idealize the faces. A composite of two photographs of the same person gives a composite far better than any photograph actually taken

[1] Inquiries into human faculty.

of the individual. The combination of a photograph of a person at one age, with that of the same person at a different age, is very much like what the person looked at an intermediate age. The effect of hair, costume, etc., often spoils the result.[1]

While the combination with an ordinary stereoscope is very satisfactory, there are a few advantages in using the original form of the instrument as it was invented by Wheatstone. This consists of two mirrors set at right angles, and two bars running out perpendicularly to the faces of the mirror. Along these bars uprights, holding the photographs, can be moved. One eye looks into each mirror, and the combination of the two images takes place. Differences in size of the photographs can be accounted for by moving the larger one farther off, and the smaller one nearer. As soon as the two images, as seen side by side, are of the same size and position, the bars are moved on their common axis until the images coalesce. The composite thus formed is even better than the Brewster stereoscope, and the arrangement lends itself to a greater variation in the experiment. Two cautions may be useful: 1°. The head must not be moved. A prong of wood attached to the instrument, and held between the teeth, will be an aid. 2°. The illumination of the two pictures must be alike, or else the more strongly illuminated will give the character to the composite.

While composite photography has always made use of photographs, there is no impossibility in making a composite directly from the original sitters. A Philadelphia photographer has been successful in producing a composite of two sisters from actual life. The method is, doubtless, more troublesome than the usual one. With the Wheatstone stereoscope, one can combine living faces by having two persons assume appropriate positions; and, as before, by guiding the movements of their heads, uniting the images in the mirrors. Both the full face and the profile give a peculiar and lifelike effect.

The most common difference in the position of photographs, as ordinarily taken, is the direction of the head; i.e., whether more of the left or the right side of the face is shown. Two photographs, looking in opposite directions, cannot be combined by any of the above methods. A simple device overcomes the difficulty. A piece of mirror is held directly in front of the face between the two eyes. The two pictures are set side by side; one is looked at directly with one eye, while the other is seen reflected, and, of course, reversed in the mirror. By moving the photograph until its reflection coincides with the other, a perfect blending takes place.

I have tried combination by means of the zöetrope. Simple figures can be satisfactorily combined; but so complicated a design as the human face, is accompanied by a vagueness of outline and detail which render the process useless. By using five or six of each of the two photographs to be combined a distinct face is seen. Even then the result is not nearly so good as in the stereoscopic combination. Besides, there is no way of accounting for small differences in the photographs. In combining several pictures, one gets nothing but a jumble of faces.

The fatal objection to all these hand-processes is, that but two photographs can be combined at once. To unite the resultant composite of two or more stereoscopes, is, perhaps, possible, but would certainly prove very troublesome. An apparatus, that, by a system of mirrors, would superimpose a series of images, suggests one method of extending the processes above described. Joseph Jastrow.

[1] I would suggest that this method offers a means of studying the nature of the expression of the emotions.

A COMPOSITE PORTRAIT OF THE OFFICERS OF THE ASSOCIATION.

The accompanying photo-engraving is a composite of the photographs of the higher officers present at last year's meeting of the

American association for the advancement of science: these were, Messrs. Newton, Lesley, Newcomb, Asa Gray, Cope, Hilgard, Putnam, James Hall, J. W. Langley, Morse, Eaton, N. H. Winchell, Wormley, Thurston, Eddy, Springer, and John Trowbridge.

It was prepared by Mr. W. Curtis Taylor of Philadelphia,[1] who had never seen a composite before preparing it: and it is therefore less successful than might otherwise be expected. As in the previous composites published by us, it makes a younger and handsomer man than the average of those whose faces enter into it. The average age of these seventeen gentlemen can hardly be less than fifty.

THE YACHT PURITAN.

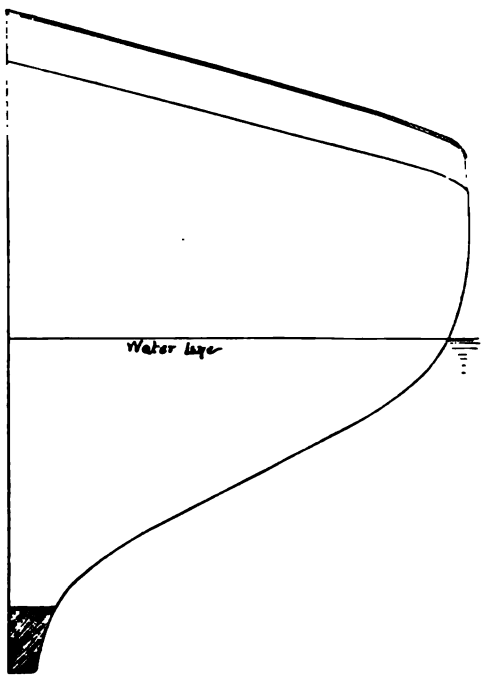
The yacht Puritan, which has just raced so successfully with the New-York sloop Priscilla, was designed by Mr. Edward Burgess of Boston with a view to combine the speed of the ordinary type of American sloop with the weatherliness of the English cutter. The race for the Goelet cup at Newport, Aug. 3, seems to show that we have, at last, a successful compromise. Puritan measures 93 feet on deck from the fore side of stern to the aft side of her long and slender taffrail. Extreme beam, 22 feet 7 inches. Draught, 8 feet 4 inches. Displacement, 105 gross tons. The lead keel weighs 25 tons; and 20 tons of lead are stowed inside, four or five tons of which are run into the garboards. The centre-board is 21 feet long and 10 feet deep. The spar measurements are: mainmast, 78 feet; topmast, 44 feet; boom, 76 feet; gaff, 47 feet; bowsprit, 38 feet (outboard). Lower-sail area, 5,500 square feet.

Many yachting critics predicted that Puritan would not carry her sail; that her lead keel, combined with so much beam, would make her very uneasy in a seaway; and that, like other compromises, she would be slow. Her record so far has, however, been entirely satisfactory. In the Newport race, while the fastest cutter yet built in America — Bedouin — plunged into every sea, finally losing her bowsprit, Puritan never put her bowsprit under, and beat the cutter *one hour* in the twenty-mile thrash to windward.

Puritan's rival, Priscilla, is undoubtedly a very fast craft; and with her rig reduced, she may yet prove a troublesome antagonist, with her five feet extra length.

The success of both boats, which a new book on the America's cup calls 'experiments,' points to a brave defence of the cup, and holds out good hope that it may still remain on this side of the Atlantic.

The midship section of Puritan, given herewith, is published for the first time. Her longitudinal section shows a rather deep forefoot with a rocker keel and raking stern-post. Both fore and after bodies are unusually fine.



The load water-line shows about five inches hollow.

The picture, showing Puritan under lower-sails and club-gaff topsail, is reproduced from a photograph taken by N. L. Stebbins in the Eastern yacht race, June 30, when she beat the next boat in her class nearly half an hour over a short course.

[1] We are indebted to the courtesy of this gentleman for the opportunity of reproducing it.

THE PRESIDENT'S ADDRESS.[1]

My Friends: I have the honor to address you this evening as an association of representatives of American science in all its branches, — as students of the sky and all its elemental forces, of the earth and all its mineral constituents, of the animal and vegetable kingdoms in their past and present ages, of the history and constitution of the human race, — and I may be easily pardoned for some trepidation in view of the draughts you may have drawn in advance on my

[1] Address to the American association for the advancement of science at Ann Arbor, Aug. 26, 1885, by Prof. J. P. Lesley of Philadelphia, the retiring president of the association.

slender exchequer. I have lain awake o' nights, like my predecessors, reflecting how I should meet my liabilities. And like them, no doubt, I find myself poorer than when, a year ago, I contracted them. You would scorn to receive in payment my promissory notes or mortgages on my castles in Spain. You will accept nothing but gold and silver, in bullion or in coin; and that is what troubles me.

There were once halcyon days for orators: the world of knowledge limited, and canopied with rosy clouds of curious speculation; the birds of fancy singing in every bush; the dew of novelty glittering on the fields. Science was then an early morning stroll with sympathetic friends, uncritical and inexpert, to whom suggestions were as good as gospel truths. Then, such a reunion as this to-night was a sort of picnic-party, at some picturesque place on the shore of the unknown, hilarious and convivial.

All that has passed away. The sun of science now rides high in heaven, and floods the earth with hot and dusty light. What was once play has turned to serious toil. Shadows are short. Objects present themselves in well-defined and separated shapes for critical examination. The few and early risers have become a multitude. The tumult of occupations distracts the studious observer. No one lends ear to chit-chat. All are hurried. Critics abound. "Say what you want, and go; or tell us something absolutely true and useful," is the introduction to every conversation. Morning, noon, and night, men demand, not the agreeable, but the necessary. The age of romance in science is part of the forgotten past. The new world has grown gray-haired in fifty years, intolerant of the irresponsibility, the sportiveness, the poetry, the music, the superstitions, the affections, of its youth; dealing only in hard facts, and in their causes and consequences; weighing and measuring all things; analyzing all things; collating, comparing, and classifying; insisting upon investigation at all points; formulating rigid laws; scoffing at the unseen and unknowable; and transmuting the fear of God and the hopes of heaven into a zeal for the exact determination of the units of force, and a confident expectation that railroads will soon traverse all the unoccupied regions of the earth, and malleable steel replace wood in the mechanic arts.

You represent this new world, grown so suddenly old, learned, utilitarian, and critical. Your orators have a hard time of it.

Am I to be the mouthpiece of the outside world, setting forth in order what it has expected of you? its praise? its blame? Nay, what care you for praise from uninspired lips? Or what care you for blame from the vulgar herd who comprehend neither your purposes nor your methods?

Am I to be your mouthpiece to inform this outside world of what the community of science which you partly represent has been about the last twelve months, giving it such a catalogue of facts discovered, and theories established or improved, that it shall stand amazed, and bless its stars, and worship? Then this address would simply be a grandiloquent stage-aside in the drama of this meeting, and no address to you.

THE YACHT PURITAN, AFTER A PHOTOGRAPH BY STEBBINS.

Must I, then, speak to you as a fellow-worker in science, contributing some fresh gift to our common stock of truths? But that would be better done, if done at all, by reading a paper on the subject in the section to which I properly belong.

I did, indeed, hesitate a while before I rejected a temptation to discuss before you this evening one or two subjects on which I have reflected for many years, — for instance, the important *rôle* which the chemical solution of the limestone formations has played in the grand drama of the topography of the globe; the absolute inconstancy of the ocean-level; the function of variable deposition in closed basins in elevating the plane at which coal-vegetation repeated itself; the influence which anticlinals and

synclinals *en échelon* have exercised in originally directing, and afterwards perpetually shifting, the systems of river-drainage, as the general surface became lower and lower through erosion; the extraordinary differences in the amount and rate of erosion in different parts of the same region, due to the various heights and shapes of the plications, — but a deep sense of insufficiency for properly handling such great subjects deterred me from the attempt. They demand the largest treatment, the fullest illustration, and the long coöperation of many minds. All the great transcendental questions of science remain open to research; not one of them has as yet been answered satisfactorily; all answers have been premature, and most of what has been published for such seems to me puerile; yet the disposition to deal in transcendental science seems to grow daily stronger. There are no laws, however, against initiation into Alpine clubs. If men choose to run fatal risks for notoriety, let them do so, in the name of all that is chilly and unprofitable; but let them not pretend, that, when they reach the summit of some Jungfrau or Matterhorn, their demon of adventure shows them all the kingdoms of the world of science, and the glory of it; for, in fact, the inaccessible sky surrounds them still, and clouds obstruct their vision in every direction. I have no fancy for such mountain-climbing, and think lightly of exploits so barren of results.

I seize the occasion, rather, to awake to your remembrance some thoughts of common interest, which the multiplying avalanches of facts and theories threaten to bury out of sight, as the pure ice of the glacier gets covered over with a sordid sheet of *débris*, perpetually tumbling from the cliffs between which it flows.

Consider, then, first, that the final cause of a glacier is not to carry moraines, lateral or medial; that these are mere accidents of its existence; and that, were it endowed with intelligence, it would feel little interest and less pride in the heterogeneous, variable, and for the most part useless, burden, which it cannot escape, and throws away at the close of its career. Such are the loads of science which we are compelled to carry forward through life, in the forms of fact and theory; misshapen, accidental droppings upon us from our local surroundings; fragmentary specimens of knowledge, of which we construct our confused and shapeless heaps of learning, most of which is of little use, either to ourselves or to the world. The life of the glacier is an elaboration of the universal moisture into snow, nevé, and pure ice, by a slow process of internal constitution; and such is the happy destiny of the true man of science, worked out in wisdom of character, apart from all accidental accumulations of learning, and mainly irrespective of them.

Let us avoid the sacrifice of character to science. As the saying of Jesus of Nazareth, that the sabbath was made for man, not man for the sabbath, has rung through the centuries, a tocsin of alarm to rouse mankind to resist ecclesiasticism, so let the warning cry fill the air of our association, from meeting to meeting, that science is our means, and not our end. Self-culture is the only real and noble aim of life. And as the magnificence, beauty, and utility of a glacier, as a perpetual reservoir of solid moisture, is not gauged by the size, arrangement, or constitutional features of its moraines, neither is the greatness and usefulness of the philosopher measured by his amount of the knowledge of the physical fact-and-theory science of the times.

Of all kinds of intellectual greatness, the greatest is achieved by the philosopher who stands before the thinking world as a model of scientific virtue; deaf to flattery; insensible to paltry, hostile criticism; patient of opposition; dead to the temptations of self-interest; calmly superior to the misjudgments of the short-sighted; whom nothing diverts from the endeavor to live nobly, and to whom noble means are as indispensable as noble ends; in whom the most brilliant successes foster neither vanity nor arrogance; to whom fame is unimportant, and poverty a trivial circumstance; whose joys, like fragrant breezes from an encircling landscape, come from the surrounding friendship of the general world, to whose best interests the noble heart is forever loyal.

Another subject for serious reflection is the over-accumulation of scientific information. To broach it before such an assembly may seem to require some apology. Certainly, the feeling prevails, that the world cannot have too much science. But the science of learning and the science of knowledge are not quite identical; and learning has too often, in the case of individuals, overwhelmed and smothered to death knowledge. The average human mind, when overstocked with information, acts like a general put in command of an army too large for him to handle. Many a vaulting scientific ambition has been thus disgraced. Nor is this the only danger that we run; for the accumulation of facts in the treasury of the human brain has a natural tendency to breed an intellectual avarice, a passion for the piling-up of masses of facts, old and new, regardless of their uses. In the great game of our spiritual existence, facts are mere counters with which to play the game. A million of them are worth nothing, unless the player knows how to play well the game; and when the game is over, the worthless counters are swept back into the drawer. And the danger pursues us to higher and higher planes of science. Not only the avarice of facts, but of their explanations also, may end in a wealthy poverty of intellect, for which there is no cure. Even the sacred fires of research may be allowed to burn too long, until, in fact, they turn the investigator into a mere miser of ideas. As for those who are not themselves original investigators, but busy themselves incessantly in appropriating the secretions of research at second hand, how often it happens that the richest additions of reliable theories to the stock of their ideas, even to a point where they suppose themselves, and are supposed by others, to know all the conclusions arrived at by past and present inquirers, leave them as thinkers just what they were at first, — incompetents; mere ill-hung picture-galleries; disarranged museums; complicated inventions

not work; costly expeditions for discovery, and abandoned in the polar ice.

temperance in science is obligatory from int of view. As mere wealth of posses- ot guarantee happiness, neither can a of learning insure wisdom. When the verfeeding grows plethoric its vital ener- and its life is endangered. The intellect chievously crammed with science. How ow is not the best question, but how we e know, and what we can do with it; and, what it has made of us. The tendency now is to subordinate the soul to that ld be merely its endowment and adorn- rn the thinker into a mere walking ency- xt-book, or circle of the mechanic arts; ice the highest type of man. What ridic- itiable creations are these! — an author- cs who cannot speak the truth? a leader istory who is given over to the torments god in chemical research sick of some ion? a youthful prodigy of mathematical ering with unelastic steps and outstretched sp his future fame? Yet no one will ie intemperate pursuit of any branch of a tendency to produce such characters, to undue importance the individual ac- of scientific facts and scientific theories, ct and depreciation of that spirit of truth can inspire and justify an earnest study rial universe. I beg you to reflect that of science as of religion, that the mere code threatens its devotee with intel- h, and that only by breathing its purest e man of science keep his better character t indefinable spirit which, in its intimate l nature, has little to do with the number scovered, or theories accepted; a spirit ly exercises itself in research, and accepts as delightful accidents; a spirit which aths of science, not as if they were turn- rging upon some smoky and squalid focus ied population, but as if they had been d flower-bordered for it through some k; a spirit of natural and cultivated noble- ned by boundless friendship for the world lives therein; just and true to all men nworthy, proud without vanity, indus- ut haste, stating its own griefs as lightly might, and generously bringing help to the and forlorn. In every one of us there is if we did but know it; and, as Emerson e moral is the measure of its health.

en saying, then, that we should pursue any other business of this life, with a dis- wavering intention to ennoble our own It were a trite addition to propose that the nade ancillary to the public good. 'The nce' is a phrase which has been greatly opular discourse; and if the phrase be its true meaning, — a zealous admiration s beautifully true and useful in nature, — rm us in the practice of our profession.

But when the imagination has exhausted itself in transcendental ecstasies over an ethereal sentiment so named, but undescribed except in poetry, what wiser or better thing can we say of any branch of physical or natural science, cultivated by our association, than that its votaries are knowingly or unknowingly bettering the condition and character of mankind? Every advancement in science is, of its own nature, an improvement of the commonwealth. Every successful study of the laws of the world we inhabit inevitably brings about a more intelligent and victorious conflict with the material evils of life, encouraging thoughtfulness, discouraging superstition, exposing the folly of vice, and putting the multitudes of human society on a fairer and friendlier footing with one another. The arts of philanthropy are, therefore, as direct an outcome of science as the lighting of the public streets, or the warming of our homes. Cruelty and shame are products of the night. The daylight is a friend to friendliness. The progress of civilization and the progress of science are alike typified by the progressively brilliant and general illumination of cities. So, in old times, human sacrifices and piracy ceased wherever the worship of the Tyrian Melcarth yielded place to the philosophy, belles-lettres, and fine arts of the genial and beautiful Delphic Apollo, the civilizer, the far shiner, the sun of Grecian righteousness, whose initiated became the educators of the modern world.

And yet these two magic words, 'initiation,' 'education,' have meanings directly the reverse of one another, — the one a *going in* to learn the secrets of esoteric doctrine, unsafe for publication because immature; the other a *being led out* from ignorance to knowledge, from helplessness to the active performances of life. The idea of universal education is wholly modern; in fact, a product of the century in which we live. It is democracy in the world of intellect. It is the doctrine of equal human rights applied to the possessions of the human brain. It is the apotheosis of common sense. It demands the distribution of knowledge in adequate quantity and quality to all who live and all who are to live upon the earth. How this is to be accomplished, is the greatest of the questions of the day; and it especially concerns us as members of an association for the advancement of science.

I do not intend to discuss the subject, to define the quantity and quality of knowledge adequate for the various classes of human society, or to propose any plans for its distribution. All I wish to say about it is, that it seems to me nature limits both the responsibilities of teachers and the rights of learners more narrowly than is commonly supposed. The parable of the sower is a good reference for explanation. Most of the surface of the globe is good for little else than cattle-ranches or sheep-farms; and the large majority of mankind must, in all ages, be satisfied with the mere rudiments of learning: what they want is unscholastic wisdom with which to fight the fight of life, and they must win it for themselves. Only a limited number of persons in any community can acquire wealth of knowledge; and the only thought

on which I wish to insist is this: these few must also get it for themselves, and, moreover, must work hard for it.

It is a hackneyed aphorism, that there is no royal road to knowledge, although an incredible amount of pains has been taken to make one. Nature, in this affair as usual, has been a good, wise mother to us all; for it is not desirable to make the acquisition of knowledge easy; for the main point in scientific education is to secure the highest activity of the human mind in the pursuit of truth; an activity tried and disciplined by hardship, and nourished on hardy fare. The quantity of food is of less importance; every thing depends on establishing a good constitutional digestion. The harder the dinner is to chew, the stronger grows the eater. Canned science, as a steady diet, is as unwholesome for the growing mind as canned fruits and vegetables for the growing body. The wise teacher imitates the method of nature, who has but one answer for all questions: "Find it out for yourself, and you will then know it better than if I were to tell you beforehand."

But who can be a wise teacher who has not been wisely taught? The spirit of this scientific age favors a universal manufacture of condensed milk to ease and cheapen the toil of bringing up its infants. It finds the bottle of literature more convenient than the breast of nature. It prefers a large family of puny children to a few young heroes. The stalwart ancients exposed their unfit offspring to the wolves; we moderns exhaust the resources of art to preserve their worthless and painful lives.

This is the spirit which invents a thousand futile plans for compacting the universe to a size so small, and a shape so simple, that it can be grasped without much effort by the tiniest and feeblest hands. Will it be an unpardonable crime for me to say that I recognize the same spirit in the present popular rage for an over-classification, unification, and simplification of science; for ultra-symmetrical formulae, and excessive uniformity in nomenclature; with an avowed reference to ease of learning and convenience of teaching, the saving of time in the acquisition of facts, and the diminution of brain-waste in collating them for use; in one word, to the making of science easy, in despite of the inexorable decree of nature, that it always shall be and always ought to be difficult? For the genius of the creation is visibly hostile to that uniformity, symmetry, and orderly simplicity which the text-book endeavors to establish. No logical consistency for her! No stiffening of the fact-producing energies into fact formularies will she endure. Hardly has a manual issued from the press but it is mutilated by her puckish fingers. No sooner has some school of theorists erected a stately structure in simple grandeur, than it is shattered by the lightning of a new revelation. There is no rest, no peace, in our believing. Our libraries contain little else than such spoiled palimpsests; the broad fields of science are covered with such ruins; and those who have grown old in travelling far and wide across them would find little cause for singing paeans to the exploits of science were it not for the fact that the function of science is not to organize nature, but by the laborious study of nature to organize the human mind, and inform it with the very genius of nature, original, unsymmetrical, indefinable, unclassifiable, changing its attitudes and operations every instant, and escaping easily from all the toils of scholastic unification which we spread for it. The work of the student cannot be simplified, cannot be made easy, if it is not to fail in its great purpose, the production of a genuine man of science. The foolish nurse thinks it her duty to carry the child always in her arms; but the test of a good education is the ability of the child to carry its nurse; and this it can only attain to through the discipline of toil; toil which at first conceals itself under the gracious guise of sports, gymnastics, and adventures, and afterwards takes the shape of experimental failures and useless constructions, but all as free, untutored, and original as the laughing, wasteful, and ungovernable pranks of nature. But I have followed long enough, perhaps you will think too long, this train of thought: let me suggest another.

It is a familiar fact, that great discoveries come at long intervals, brought by specially commissioned and highly endowed messengers; while a perpetual procession of humbler servants of nature arrive with gifts of lesser moment, but equally genuine, curious, and interesting novelties. The excitement of the pageant incapacitates us for reasoning rightly on its meaning. From what unknown land does all this wealth of information come? Who are these bearers of it? and who intrusted each with his particular burden, which he carries aloft as if it deserved exclusive admiration? Why do those who bring the best things walk so seriously and modestly along, as if they were in the performance of a sacred duty for which they scarcely esteem themselves worthy; while those who have little to show, or things of inferior or doubtful value, strut and grimace magnificently, as if they felt themselves the especial favorites of nature, push to the front, speak loudly to the multitude, and evidently deem themselves entitled to uncommon honors?

In this procession of science, in this interminable show of discovery, two facts arrest attention: first, the eager gaze of expectation which the crowd of lookers-on direct towards the quarter from which the procession comes, and their unaccountable indifference to what has already passed; and secondly, the wonderful disappearance, the more or less sudden vanishing out of the very hands of the carriers, of a large majority of the facts and theories of which they make so pompous an exposure; few of them, however, seeming to be aware that thereby they have lost their right to participate in the pageant, and should retire from it into the throng of spectators, at least until good fortune should take pity on them, and drop some new trifle at their feet to soothe their wounded vanity.

You will not suspect me of depreciating the value of any real discovery, be it merely the finding of a Californian bird on the shore of Massachusetts Bay, or detecting, with the naked eye, the blazing of a

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of our methods, by the ennoblement of our personalities, and by these alone, can we rightly discover whether or not our association is fulfilling its destiny by advancing science in America. If, unhappily, our meetings should rather tend to cultivate a love for *bric-à-brac* in science, if the stimulation and gratification of a quasi-animal curiosity for scientific novelties be fostered, if our discussions should become hot-beds of a more vigorous vegetation of personal vanity, intellectual pugnacity, lust for notoriety, literary jealousies, conceited reclamations, petty ambitions, or pecuniary schemes, how is our day and generation to be benefited or improved? If our attention become restricted to the details of the creation, and to the smaller manœuvres of the forces of nature; or if, on the other hand, we become habituated in the indulgence of vague generalizations, suggestions of possible theories, and half-completed or merely sketched and outlined hypotheses, — how are we ourselves, as workers of science, to escape deterioration?

I cannot shake off a suspicion that we talk and write too much; that the whole world talks too much; and that the golden time for silence is precisely then when we come together to talk. Were each of us to utter only what he absolutely knows, what he is quite sure of, what he has unimpeachable facts in sufficient number to confirm, — what a sudden illumination would overspread our meetings, glorifying our science, and re-inspiring us all! But I turn from the Utopian fancy, and invite your attention to a very different theme.

There is a topic which I think should be frequently considered by all who engage in scientific pursuits; and by none so earnestly as by those who are ambitious to reach the higher points of view, from which to survey and describe those systematic combinations of phenomena which are more or less panoramic: I allude of course to generalizers or discoverers of natural laws, and the professional teachers of such laws; while those who deal in itemized science, the mere observers of isolated facts, discriminating specimens and naming genera and species in the animal, vegetable or mineral worlds, and especially such as occupy themselves with geographical and geological studies in detail, stand in less need of having it pressed upon their attention, because in their case it insists upon its own necessity.

I allude to what is technically known among experts as 'dead-work.'

This topic has to be treated in the most prosaic style. To describe dead-work is to narrate all those portions of our work which consume the most time, give the most trouble, require the greatest patience and endurance, and seem to produce the most insignificant results. It comprises the collection, collation, comparison and adjustment, the elimination, correction and re-selection, the calculation and representation — in a word, the entire first, second, and third handling of our data in any branch of human learning, — wholly perfunctory, preparatory, and mechanical, wholly tentative, experimental, and defensive, — without which it is dangerous to proceed a single stage into reasoning on the unknown, and futile to imagine that we can advance in science ourselves, or assist in its advancement in the world. It is that tedious, costly, and fatiguing process of laying a good foundation which no eye is ever to see, for a house to be built thereon for safety and enjoyment, for public uses or for monumental beauty. It is the labor of a week to be paid for on Saturday night. It is the slow recruiting, arming, drilling, victualling, and transporting of an entire army to secure victory in one short battle. It is the burden of dead weight which every great discoverer has had to carry for years and years, unknown to the world at large, before the world was electrified by his appearance as its genius. Let us examine it more closely: it will repay our scrutiny. Those of you who have been more or less successfully at work all your lives may get some satisfaction from the retrospect; and those who have commenced careers should hear what dead-work means, what its uses are, how indispensable it is, how honorable it is, and what stores of health and strength and happiness it reserves for them.

My propositions, then, are these: 1°. That, without a large amount of this dead-work, there can be no discovery of what is rightly called a scientific truth. 2°. That, without a large amount of dead-work on the part of a teacher of science, he will fail in his efforts to impart true science to his scholars. 3°. That, without a large amount of dead-work, no professional expert can properly serve, much less inform and command, his clients or employers. 4°. That nothing but a habitual performance of dead-work can keep the scientific judgment in a safe and sound condition to meet emergencies, or prevent it from falling more or less rapidly into decrepitude; and 5°. That in the case of highly-organized thinkers, disposed or obliged to exercise habitually the creative powers of the imagination, or to exhaust the will-power in frequently recurring decisions of difficult and doubtful questions, dead-work and plenty of it is their only salvation; nay, the most delicious and refreshing recreation; a panacea for disgust, discouragement and care; an elixir vitae; a fountain of perpetual youth.

In expanding these propositions, I would illustrate them in some such homely ways as should make them seem near and familiar principles of conduct; and of course I can only do this out of the experience of my own life, and from observation of what has happened in the limited sphere of one department of scientific inquiry; but that should suffice, seeing that work is work, and science science, however various may be minds and their pursuits.

First, then, is it so that scientific truths cannot be discovered without a large amount of preliminary dead-work? Surely no one in this assembly doubts it who has established even one original theory for himself, or won for it the suffrages of judges capable of weighing evidence. Now the immense disproportion in numbers between theories broached and theories accepted is the best proof we could have, not only of the value and necessity of dead-work, but of the scarcity of those who depend upon it as a prepara-

tory stage of theorizing. And, moreover, not theories only, but simple statements of fact believed and disbelieved, that is, finally accepted or finally rejected, exhibit the like numerical disproportion, and betray a general carelessness or laziness of observers; at all events, their manifest lack of appreciation of the value and necessity of the dead-work part of observation, which imperatively must precede any clear mental perception of the simplest phenomenon, before the attempt is made to establish its natural relationships, and present it for acceptance as a part of science.

A geologist travels far to collect fossils at a particularly good locality, stops there a day or two, fills his valise, and returns to publish a paper on it. What is his paper worth? Were he first to spend a week in making himself acquainted with the whole vicinity, a second week in making measured sections of all the cognate outcrops in the neighborhood, a third week in carefully differentiating the specific horizons, and a fourth week in verifying their reliability, and in correcting his first mistakes, then, surely, whatever labor he should afterwards expend upon his collection of life-forms would have its full value; and any paper he might write would be an important contribution to his branch of science.

I have known men settle to their own satisfaction some of the greatest problems in geology by a flying reconnoissance; triumphantly overturning a mass of accumulated science slowly brought to demonstration by many years of conscientious dead-work, which they did not seem to think it worth their while to verify. I have known men reclassify the elements of a geological system by a few sections, not a single one of which was properly measured by them, or could be properly put on paper in a graphic form for precise comparison. I have known men make what they called a geological map, without having run a single instrumental line themselves; with every outcrop inaccurately placed; with only here and there an accidental note of strike and dip, and even this not oriented with a close approximation to precision; covering a region requiring the study of many months, with a few weeks of what they fondly called field-work; and basing on such a map generalizations of the first rank, for which they expected the world of science to give them credit; which in the long run it certainly will, but not the kind of credit they anticipate.

Now, the experience of a long and active life of science has trained me to regard all such work as careless work, lazy work. Not that such workers are lazy men in the common meaning of the word; on the contrary, they are busy, bustling, active, energetic, indefatigable men; in fact, too much so. In science, there is a laziness of quite another definition; namely, a chronic dislike, a deep-seated disability, for the dead-work which first disciplines to accuracy, then makes patient and cautious, and finally bestows the clearest intelligence and largest comprehension of phenomena. And this fatal laziness is fostered by a strange misunderstanding, a fancy, sometimes a downright conviction, that the dead-work of science can be done for us by some one else, so as to save our time and strength for speculation, for thought, for fine writing; can be done by menials, employees, assistants, colleagues, special experts, — by any one rather than by ourselves. Can we not in fact often find it already done for us, and even better done than we could do it? Then, why not let inferior minds occupy themselves with this laborious and time-consuming address of special skill? Can we not, for instance, hire transit-men to lay out and measure our sections, and artists to draw them? Why should a paleontologist take the pencil between his own fingers in studying species, when he has trained photographers and lithographers at his command? Why waste precious weeks and months in tramping and climbing, in measuring and plotting, while glory calls us, and the scientific world is impatiently waiting for our conclusions? Thus possessed by the demon of scientific haste, we continually spoil our own performances, and disappoint the expectant, but not at all impatient world. Could our vanity permit us to know the fact, the impatience is entirely our own, and, if indulged, is sure to be roundly punished.

No; dead-work cannot be delegated. The man who cannot himself survey and map his field, measure and draw his sections properly, and perfectly represent with his own pencil the characteristic variations of his fossil forms, has no just right to call himself an expert geologist. These are the badges of initiation; and the only guaranties which one can offer to the world of science that one is a competent observer, and a trustworthy generalizer. Nor has one become a true man of science until he has already done a vast amount of this dead-work; nor does one continue in his prime, as a man of science, after he has ceased to bring to this test of his own ability to see, to judge, and to theorize, the working and thinking of other men. But enough of this.

My second proposition was, that no teacher of science can be successful who does not himself encounter some of the dead-work of the explorer and discoverer; who does not discipline his own faculties of perception, reflection, and generalization, by field-work and office-work, independently of all text-book assistance; who does not himself make at least some of the diagrams, tables, and pictures for his class-room, in as original a spirit, and with as much precision of detail, as if none such had ever been made before, and these were to remain sole monuments of the genius of investigation. What the true teacher has to do first and foremost, is to wake up in youthful minds this spirit of investigation *ab initio*. The crusade against scholastic cramming promises to be successful; but the crusade against pedagogic cramming has hardly yet been organized. How is the scholar to be made an artist if the teacher cannot draw? The instinct of imitation in man is irresistible. Slovenly drawing on the blackboard — sufficient evidence of the teacher's imperfect information and inaccurate conception of facts, the nature of which he only thinks he understands — can do little more than raise a cold fog of suspicion in the class-room, by which the tender sprouts of learning must be

either dwarfed or killed. But even slovenly diagrams are preferable to purchased ones; for whatever diminishes the dead-work of a teacher, enervates his investigating, and thereby his demonstrating, powers, and lowers him toward the level of his scholars.

Were I dictator, I should drive all teachers of science out into the great field of dead-work; force them to go through all the gymnastics of original research and its description; and not permit them to return to their libraries until their note-books were full of their own measurements and calculations, sketch-maps and form-drawings, severely accurate and logically classified, to be then compared with those recorded in the books. What teachers fail to keep in mind is this: that learning is not knowledge; but as Lessing says: Learning is only our knowledge of the experience of others; knowledge is our own. No man really comprehends what he himself has not created. Therefore we know nothing of the universe until we take it to pieces for inspection, and rebuild it for our understanding. Nor can one man do this for another; each must do it for himself; and all that one can do to help another is to show him how he himself has morsellated and recomposed his small particular share of concrete nature, and inspire him with those vague but hopeful suggestions of ideas which we call learning, but which are not science.

My third proposition was, that an expert in practical science can command the respect and confidence of his professional fellows, and, through their free suffrages, build up his own reputation in the learned and business worlds, only in exact proportion to the amount of good dead-work to which he voluntarily subjects himself. For, although the most of it is necessarily done in secrecy and silence, enough of it leaks out to testify to his honest and diligent self-cultivation; and enough of it must show in the shape of scientific wisdom, to make self-evident the fact that he is neither a tyro nor a charlatan. More than once I have heard the merry jest of the Australasian judge quoted with sinister application to experts in science. When a young colleague, just arrived from England, asked him for advice, he answered: Pronounce your decisions, but beware of stating your reasons for them. Many an ephemeral reputation for science has been begot by this shrewd policy; but the best policy to wear well is honesty; and honesty in trade means selling what is genuine, well-made, and durable; and honesty in science means, first, facts well proved, and then, conclusions slowly and painfully deduced from facts well proved, in sufficient number and order of arrangement to exhaust alike the subject and the observer. Reap your field so thoroughly that gleaners must despair. Fortify your position, that your most experienced rival can find no point of attack. Lay your plans with such a superfluity of patient carefulness that fate itself can invent no serious emergency. Demonstrate your theory so utterly and evidently that it shall require no defender but itself. Die for your work, that your work may live forever. Forget yourself, and your work will make you famous. Enslave yourself to it, and it will plant your feet upon the necks of kings, and your mere Yes or No will become a law to multitudes. This is what the dead-work of science, when well done, does for the expert in science.

My fourth proposition — that only the habitual performance of dead-work can preserve the scientific intellect in pristine vigor, and prevent it from becoming stiffened with prejudices, inapt to receive fresh truth, and forgetful of knowledge already won — hardly needs discussion. Human muscles become atrophied by disuse. Men's fortunes shrink and evaporate by mere investment. I pray you to imagine what I wish to say; for it all amounts to this — that the grass will surely grow over a deserted foot-path. Let me hurry to the close of this address, which I have found too serious a duty for my liking, and perhaps you also have found it too personal a preachment for yours. One more suggestion, then, and I have done.

My fifth proposition was, that the wearied and exhausted intellect will wisely seek refreshment in dead-work.

The physiology of the brain is now sufficiently well understood to permit physicians to prescribe with some assurance for its many ills, and to regulate its restoration to a normal state of health. Its tissues reproduce themselves throughout life if no extraordinary overbalance of decay takes place, if there be no excessive and too long continued waste. For the majority of mankind, nature provides for the adjustment between consumption and reproduction of brain-matter, by the alternations of day and night, noise and silence, society and solitude; and also by the substitution of the play of fancy in dreams, for the work of the judgment and the will in waking hours. We follow the lead of nature when we seek amusement as a remedy for care. We bring into activity a rested portion of the brain, to permit the wearied parts of it to restore themselves unhindered.

This is the rationale of the pathological treatment of the brain. Tell an over-worked president of a railway company, who falls asleep at the director's meeting, that he must *rest*, or die of softening of the brain, and he will smile a sad reply, that he *cannot rest*. He is right, thus far: he cannot rest his whole brain; but he can rest the cerebellum, — the seat of the will power, — by bringing into higher activity, and more frequent exercise, the upper and frontal lobes. Let him stop thinking of leasing rival lines, and read novels, and play billiards. Let him ride some youthful hobby, revive his practise on the violin, cultivate flowers, keep a stud and kennel, bury himself in Greek and Latin literature, collect pictures, minerals, do any thing which will really interest him, and keep him out of the way of railroad men and railroading; and do it with his might, with enthusiasm, even to fatigue; and do it for at least four years, and by that time his cerebellum will be all right again.

Now what the unintermitting responsibilities of the railroad official do for the destruction of the constitution of his cerebellum, just that the over-strained exercise of the creative imagination does

demoralization of the brain of the man of especially if it be, as it commonly is, ac- ied by business anxiety. And his only way pe from a predestined break-down is through notonous, but interesting occupation of his ive faculties in the field, and at his office In both he will enjoy that solitude which re- s sleep, in being a medicine for the weary brain. is a solitude peopled with unexceptionable ; in which care sleeps, and pleasure wakes; ide in which the soul multiplies itself by alli- ith all the possibilities of number, and all the ties of form; a solitude from which a man to the society of his fellow-men, sainted blessing of nature, and equal to the duty of ce.

onclusion, I must express the wish that this g of our association may be as delightful and as as any that it has ever held. Those who re- r how hard we used to work at them, what a t of mutual confidences we used to gather at and what a glow of fresh enthusiasm we car- way with us from them, will know what such implies. Those who come fresh to this meet- l find themselves made at home in half a dozen of science at once. That is the particular ter and special charm of this association, n it differs from all local societies, and from all tions of workers in special branches of science . And, as each meeting furnishes a panoramic f the present state of human knowledge as a so, at each meeting, the old and the young in are mingled in such friendly and confidential urse, that the prospect extends both backwards beginnings of inquiry, and forwards to its pos- chievements. All good tradition is precious; is well-trained current inquiry, and so is prophetic calculation. At such a meeting as e enjoy the rare privilege of assisting at all and, when we scatter to our homes, we can fail to take with us something effectual for ing and sweetening another year of work.

STANLEY'S KONGO.

r hundred years ago, a Portuguese navi- , sailing along the western shores of Afri- iscovered the mouth of a mighty river, , for many years, was known as the Rio o, or Pillar River, flowing through the om of Kongo. In 1578, however, Lopez bed it as the Zaire — a corruption of the e word for river. The Portuguese still t the Zaire; but English map-makers, the early part of the seventeenth cen- have used the word Kongo as a designa- of either the whole or a part of its lower e. There is no good reason for this: of all things, geographical names are the least susceptible to reason; and Kongo seems destined to drive out all other appellations, and to spread over the whole course of the river and surrounding country.

The early voyagers confined their explorations to the mouth of the river; and the first attempt, of which we have reliable information, to penetrate inland along its banks, was made by an Englishman, Capt. Tuckey, in 1816. Thirty white men started on this ill-fated expedition: eighteen died almost immediately; and the remainder returned to England, after having been on the river three months, and having explored it for the comparatively short distance of one hundred and seventy-two miles, the greater part of which was by water. This terrible loss of life deterred others from penetrating the unknown regions by the Kongo route. In 1867, however, David Livingstone, travelling westwards from Lake Nyassa, found the Chambezi River, which he afterwards traced to Lake Bangweolo, or Bemba. Thence, under the name of Luapula, it flowed into Lake Mweru, and was met with again at Nyangwe as the Lualaba. Thus much Livingstone had discovered before he died on the shores of Lake Bangweolo. His remains were lovingly escorted to the ocean by his negro servants, and were interred in Westminster Abbey with befitting ceremony. Stanley — then known as the correspondent of the *Herald*, who had penetrated to Lake Tanganika in a successful attempt to find Livingstone — was one of the pall-bearers. Not long afterwards, he strolled into the office of the London *Daily telegraph*. While talking with some of the staff, the editor, Edwin Arnold, entered. The conversation turned upon Livingstone and his work. Suddenly Mr. Arnold, who had been fascinated by the explorer's eye, asked him if he could and would complete the task. As a result of this interview, Stanley reached Nyangwe in October, 1876. He followed the Lualaba to the sea, and proved that the Zaire of the Portuguese, the Kongo of Tuckey and the English map-makers, and the Lualaba, Luapula, and Chambezi of Livingstone, were one and the same river. He then returned to Europe, and soon found himself at the head of an expedition to open the heart of the Dark Continent to the trade of the civilized world *via* the Kongo. These two volumes contain the history of that work.

The estimated length of the Kongo[1] — from its mouth in the Atlantic, to its source in the Chibale Hills, a little to the east of the southern end of Lake Tanganika — is 3,034 miles.

Congo, and the founding of its free state. By HENRY LEY, *with illustrations and maps.* 2 vols. New York, , 1885. Pp. 28+528, and 10+483. Illus., maps. 8°.

[1] The total estimated length of the Amazon is 4,000 miles; of the Mississippi, 3,160; and of the Missouri-Mississippi, 4,265. —cf. *Imperial Gazetteer*, 1876.

as follows: From the ocean to Vivi, at the head of navigation from the sea, is 110 miles. Thence to Isangila at the upper end of the lower Livingstone Falls is 50 miles. Between Isangila and Manyanga, 88 miles away, the river is 'tolerably navigable.' From Manyanga to Leopoldville, for 85 miles, it pours over the upper Livingstone Falls. Leopoldville once attained, the river can be navigated for 1,068 miles to the foot of the Stanley Falls. Thence to Nyangwe is 385 miles. From Nyangwe to its source — including the lakes — is 1,248 miles. It must be understood, however, that much of this last section of the river has never been explored, and that therefore it may turn out to be longer.

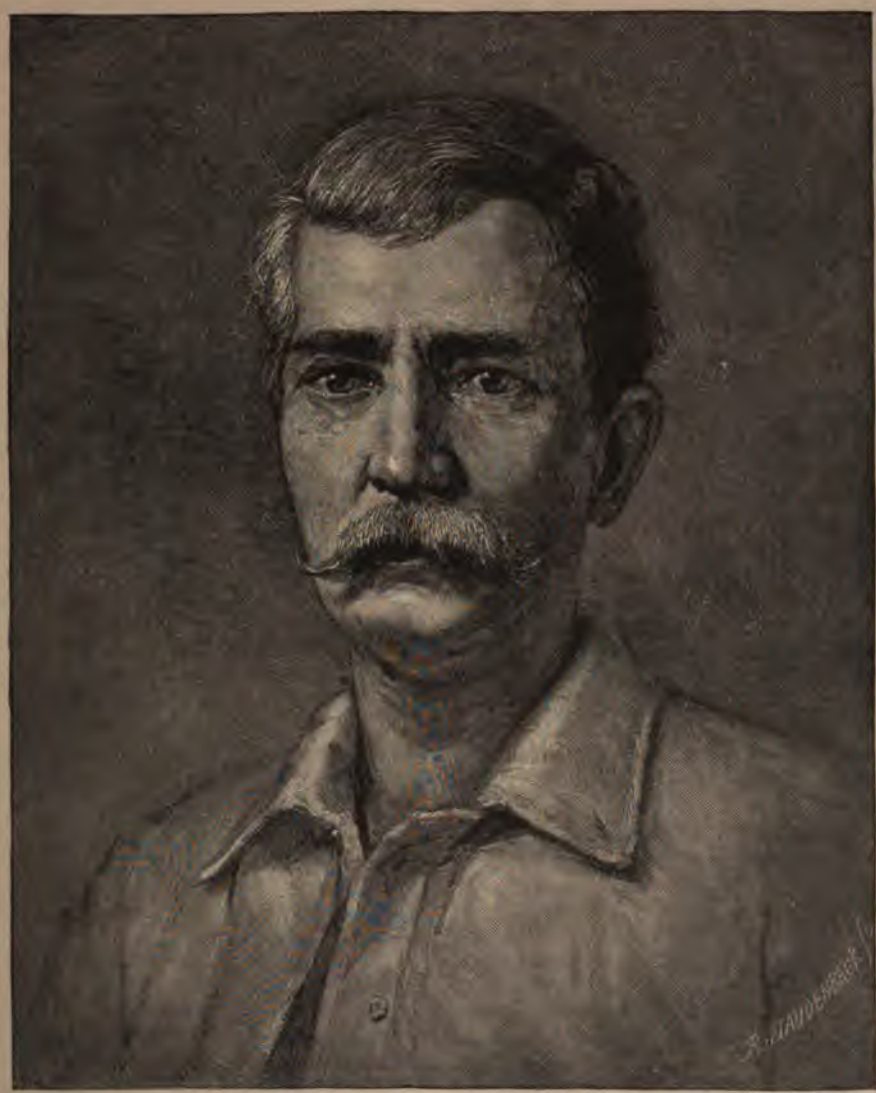
Stanley's first and most difficult work was to open a road around the Livingstone Falls, and to launch two small steamers in Stanley Pool. His force of a little over a hundred men was singularly inadequate to the task: and a whole year elapsed before the first section of the road — from Vivi to Isangila, a distance of fifty-two miles — was constructed, and three steamers dragged over the hills, and put into the river. So great were the difficulties of this undertaking, that it is almost impossible to applaud too highly the resolution and energy of the chief of the expedition. None the less, however, is it to be regretted, that he was compelled to purchase the co-operation of the natives by gifts of ardent spirits. 'It was the custom,' he says, and could not be resisted. Between Isangila and Manyanga, a ferry was established, one of the steamers being employed on that service. With the other two, he pushed on overland again; and the end of the next year found him established at Leopoldville, above the falls. The road-making was over, and Stanley was at liberty to explore the great river and its tributaries as far as Stanley Falls. He discovered Lake Leopold II., and ascended many streams. It was at the mouth of the Biyerre that he first heard of the presence of the Arab slave-traders, whom he came across some distance farther up-stream. They had with them 2,300 slaves, — the spoil of 118 villages, — 'obtained,' to use his own words, 'at the expense of 33,000 lives.' This is probably an exaggeration. But if the Kongo Free State is to be a success, commercially or otherwise, it is evident that slave-hunting, on such an extensive scale at least, must be stopped. Is the International association strong enough to put an end to it?

Stanley estimates the navigable length of the Kongo basin between Leopoldville and Stanley Falls, including tributaries, at 5,249 miles: but much of this estimate is pure guesswork. As an example of this, take the following: "Sixty miles above the Lukanga, we arrive at the fine river Mohindu. We only explored it for about eighty miles; but, considering its magnitude and the native reports, we may estimate its navigability to be about 650 miles!" Are not native reports and magnitude rather insecure data upon which to found such an estimate, especially when the Lubiranzi and the Chofu are impassable twenty-five miles from their confluences with the Kongo? A similar flavor of exaggeration characterizes the whole chapter on the commercial value of the river.

It is perfectly easy to see that the future growth of the Free State depends upon connecting some station on Stanley Pool — probably Kinshassa, as Leopoldville is very unhealthy — with the portion of the river below open to sea-going vessels. Mr. Stanley, therefore, has endeavored to show that such a road could be built, and operated with profit: "As a mere speculation, there is nothing in the whole world offering so remunerative an investment of capital as this small railway." The cost of construction, he argues, at £4,000 per mile, — surely a low estimate, — would amount to only £940,000, with an assured gross revenue of £300,000 per annum. Supposing his estimate of cost and gross revenue to be correct, what would be the net revenue? How could the road be built? By Europeans? They could not stand the climate. By Africans? Where could they be obtained, and how paid? Then, again, could the government of the Kongo State grant a right of way, or would that have to be purchased of the natives at considerable expense? Could that government protect the line against native aggression? Finally, if profitable, would not a rival line be built by the French to Brazzaville, their station on the northen shore of Stanley Pool? — a station, by the way, which is not to be found on Stanley's map. These questions do not seem to have been considered by our author, as they certainly should have been.

An obstacle to the development of the Kongo State, beside which this transportation problem dwindles into insignificance, is to be found in the climate. Take Stanley himself as an example. Assuredly no one will dispute his experience in African travel, nor his energy and resolution. Yet, after one year on the Kongo banks, he gave himself up for lost, summoned his men about him, and prepared to

die. His recovery, at that time, he attributes to a dose of sixty grains of quinine. Two years later he again broke down, and fled to Europe for safety. His European staff numbered from first to last 253 men. Of these, 23 died from sickness, 4 were killed by accident, and 92 returned home. They were all in the prime of life. At first this sickness and intense desire to get away from the deadly river is laid by our author to 'whisky;' next, to 'malingering' and 'sojering.' Finally, however, although without recalling one of the hard words he had written of his subordinates, Mr. Stanley confesses that his principal stations, Vivi, Manyanga, and Leopoldville, were located on very unhealthy sites. They were all on high land, and exposed to the cold winds blowing up-stream from the ocean. Strangely enough, the low-lying stations above Leopoldville seem to have been very healthy. There has been almost no sickness; for instance, at Equator Station, "with a river only five feet



HENRY M. STANLEY (London *Illustrated News*).

below its foundations, creeks sable as ink surrounding it, and the ground unctuous with black fat alluvium." Not a pleasant place to live in, one would say, but healthy, nevertheless. This is a curious condition of affairs, and deserves to be carefully studied by some disinterested person of scientific attainments. In summing up a fifty-page argument, written to prove that the climate is not so much at fault as the individual, Mr. Stanley practically admits the unhealthiness of the whole region. "One more observation," he says, "will suffice. However well the European may endure the climate by wise self-government, years of constant high temperature, assisted by the monotony and poverty of the diet, cannot be otherwise than enervating and depressing, although life may not be endangered. To preserve perfect health, I advise the trader, missionary, coffee-planter, and agriculturist, who hopes to maintain his full vigor after eighteen months' residence, to seek three months' recreation in northern Europe." What a prospect to hold out to the emigrant! Three months out of every twenty-one to be passed away from his business or farm! Would not the expense of such journeyings eat up the profits of the eighteen months of hard work? And how about wife and children? Are the settlers of Kongo State to be bachelors? or are they to be at home only in those three months passed in northern Europe?

Mr. Stanley has not improved as a writer during the last six years. His volumes are full of descriptions of the river and its banks. But they are not interesting, except for the amount of food for thought they contain. His tone, too, towards his understrappers, is very ungracious, to use no harsher term. The maps are excellent, although it is difficult to see why the eastern half of the large map was not extended to the ocean; and a map on a larger scale of the country around the Livingstone Falls should have been added. With a few exceptions, the illustrations are wretched. They will not bear a moment's comparison with those in H. H. Johnston's 'Congo from its mouth to Bolobo.' Only seventeen out of the hundred and twenty-two are stated to have been made from photographs or sketches. The rest seem to have been drawn on demand, so to speak, in London. The wood-engraving, too, is very poor, the pictures having a hard and flat appearance that is unpleasing to the eye; while the flamboyant cover-design of a negress poised on the Belgian coat-of-arms defies description, and must be seen to be appreciated.

NOTES AND NEWS.

— The Electric power company of New York announce that they have established an electric railway running from Baltimore to Hampden, two and a half miles. The road is very crooked, and the gradients are as high as three hundred and fifty-two feet to the mile. The motor draws a loaded car, carrying sixty-five passengers without difficulty, stopping and starting on the grade without slip of the wheels.

— Mr. Edward Burgess, the designer and builder of the new yacht Puritan, is the secretary of the Boston society of natural history.

— The report in the newspapers of the country of a shower of meteoric stones at Salem, Ind., and the injury by them to buildings and several persons, proves to be without any foundation in fact.

— The Macmillans have just issued an 'Elementary algebra for schools,' the joint work of Mr. H. S. Hall, assistant master at Clifton College, and Mr. S. R. Knight, late assistant master at Marlborough College, — a work which is said to differ in some important respects from the text-books now in use. The same publishers also announced a 'Treatise on differential equations,' by Mr. A. R. Forsyth, Fellow of Trinity College, Cambridge, and an 'Arithmetic for schools,' by the Rev. J. B. Lock, whose works on trigonometry have been favorably received.

— The schooner Rosario, at New York, reports that on June 23, in lat. 20° 14′ N., long. 133° 35′ W., at 11 A.M., two heavy shocks of a submarine earthquake were experienced. These were about one minute apart; and the last was much heavier than the first, causing the vessel to tremble violently. The sky was overcast, and the sea remarkably smooth.

— Among the French species of the genus Polygonum, hybrids are rare in a state of nature; although there are two kinds of flowers, one fertile, the other sterile. In reply to some criticisms upon Gandoger's work on this group, he replies that this fact does not necessarily mark a degradation, but simply a different aptness in fecundation among different flowers: and that, although the absence of fertile grains point toward hybridity, this is not a sure sign.

— As much of recent geographical discovery in Asia has been due, says the *Athenæum*, to native explorers trained in the surveyor-general of India's department, it will be interesting to place on record a list of the rewards lately granted by the government of India to some of the more prominent of these pioneers of Indian commerce. The most distinguished of them all, A. K., has received the title of Rai Bahadur, and with it a *jaghir* of rent-free land. The explorer known as 'the Bozdar' has been made a Khan Bahadur, and he also has received a grant of land. 'The Meah,' who accompanied Mr. McNair in his journey to Kafiristan, has been rewarded with a sum of money, and the same recompense has been given to A. K.'s companion; while a piece of plate has been presented to Mr. Penny, a planter who afforded the survey-officers much assistance during the Aka operations.

SCIENCE.

FRIDAY, SEPTEMBER 4, 1885.

THE FUTURE OF THE LICK OBSERVATORY.

THE history and description of this observatory, and the astronomical work already accomplished on Mount Hamilton, which we have given on a later page, lead very naturally to a statement of the chief advantages which, in so far as the observatory and its position and equipment are concerned, may reasonably be expected to accrue from this new departure in astronomical science.

The fact of mere elevation (less than a mile) above the sea-level will not, as is often supposed, greatly increase the apparent light of celestial objects, as the stars will appear to be only a small fraction of a magnitude brighter on the mountain than at the sea-level. But — what is incomparably more important — the gain in steadiness of the atmosphere at this elevated station has already been proven to be much greater than any one expected at the outset, and will enable the astronomer not only to make good use of a multitude of clear nights which, at less elevated stations, are found to be of little value, but also to elevate the grade of all his work to the last degree of precision. The perfection of this site for observations with the meridian circle — in fact, for all micrometric observation of whatever sort — will force the invention of better methods of eliminating personal and instrumental errors than we now possess. So far as the conditions of vision affect the stars' diurnal motion, the errors introduced in stellar co-ordinates will be so small that two or three observations of a star will suffice for the most accurate determination of its position. An enormous saving in the labor of observation and reduction is thus possible, if only the other errors can be eliminated with certainty from so small a number of observations. With regard to the influence of elevation upon the conditions of day-vision, it should be noted here that the testimony of Mr. Burnham in 1879, of Professor Holden in 1881, and of Professor Todd in 1882, is uniformly to the effect that the atmosphere above Mount Hamilton is quite as unsteady during the daytime as at other stations. This remark, however, must be understood as applying only to the period of the year from the middle of August to the middle of December, as no accurate observations upon this matter have been made in other months. It is very possible that the conditions of the atmosphere in late spring and early summer may give an entirely different experience at these seasons.

The elevation above a mile of the lower atmosphere becomes significant in another way, however, as it makes effectively available a much larger region of sky than can be commanded at other stations in a like latitude, where observations at zenith distances much greater than seventy degrees are usually not worth the making. Mr. Burnham directs attention to this fact, as affecting observations in that portion of the southern celestial hemisphere which is ordinarily inaccessible for observations of precision at our northern observatories. At the latitude of Mount Hamilton, the fifty-third parallel of south declination is about co-incident with the south horizon; and, out of forty-two new double-stars discovered by Mr. Burnham during his residence upon the mountain in 1879, twenty are between the thirtieth and fortieth parallels of south declination (that is, between limits of maximum altitude equal to twenty-three and thirteen degrees); and five of the new stars are between the fortieth and forty-fourth parallels, or between limits of maximum altitude equal to thirteen and nine degrees only. This important advantage will not be confined to the southern horizon only, but will duly influence all fields of astronomical inquiry where important observations have occasionally to be taken near other parts of the horizon.

The prevalence of violent winds on the summit, and particularly their effect upon the steadiness of the atmosphere, have not yet been thoroughly investigated. As a general rule, astronomers at ordinary elevations expect to find severe winds accompanied by atmospheric conditions which do not admit of satisfactory micrometric work. Mr. Burnham found that moderately strong winds did not seem to affect the optical steadiness of the atmosphere. A remarkable experience of my own on the mountain may be mentioned here. On the night of the 2d of December, 1882, when the wind was blowing steadily with such violence as to make it extremely hazardous to open the dome in the face of it, I found Jupiter and Saturn very unsteady and much

blurred; but turning to Sirius, I found the companion an extremely conspicuous object, — in fact, the note in my observing-book is to the effect that the companion was "as readily seen as a satellite of Jupiter." So far as I am aware, this is a unique experience of the effect of severe wind upon the optical quality of the atmosphere.

The location of the observatory in a region which is entirely cloudless during the greater part of the year, constitutes an advantage which only those can fully appreciate whose work has suffered serious interruption from the lack of a continuously clear sky. Should those permanently in charge of the observatory find it desirable to continue observations throughout the period of five months known as the 'rainy season,' it would doubtless be found that the superior elevation would afford a clear sky throughout one-third to one-half of this period, and simultaneously with clouds and storms at stations lower down. During my own residence on the mountain in the latter part of 1882, and shortly after the beginning of the rainy season, this was frequently the case; and on two separate occasions we were favored with an uninterruptedly clear sky for more than seventy consecutive hours, being situate on an island in a sea of cloud which obscured every thing beneath the immediate summit. A series of excellent photographs of this cloud-sea was obtained, one of which is well reproduced in the illustration on p. 191. Ocean fogs rarely reach the elevation of the observatory. Mr. Burnham observed these fogs drifting in from the Pacific nearly every night at about the time of sunset. Their usual altitude was about two thousand feet, and they did not appear to affect the seeing.

The instrumental equipment of the observatory, although incomplete, is already an unusual one, and, in its final state, will surpass that of all other observatories. The instruments have been designed, constructed, and mounted in the most thorough manner; and particular care has been taken that all the movable portions of the buildings covering these instruments (always a source of unending trouble and vexatious delay to the astronomer) shall be so arranged and constructed as to cause a minimum of annoyance and interruption.

The great advantages arising from the observers' ability to reside near their instruments must not be overlooked here. A suitable dwelling-house for the observers has been provided in the immediate proximity of the instruments, so that all the time available for observatory work may be fully utilized.

The means of publication — a most important consideration in the management of a great observatory — has not escaped due notice. The legislature of California has already shown its entire appreciation of the observatory and its work, by the passage, at its last session, of a joint resolution providing for the issue of such reports, observations, and researches, as may, with the approval of the governor of the state, be submitted by the Lick trustees, or the regents of the university, for publication.

Finally, and most important of all, there is an assured endowment of generous proportions, the income from which is wholly available for the maintenance of the establishment, and the prosecution of its work. The considerate management of the trustees will enable them to complete the observatory at a cost not much exceeding three-fifths of the entire allotment of Mr. Lick's bequest for this purpose, and the remainder will constitute the permanent endowment-fund of the institution.

Fortune and necessity, however, do not fail to accompany this unique combination of opportunities with more or less of disadvantage. The unavoidable obstacles of the undertaking have been great, but they have also been surmounted. But the necessary expense of maintaining so large an establishment at so elevated a station, the cost of living, the social isolation of the astronomers, amounting to practical exile for months at a time when series of observations requiring uninterrupted attention are in hand, — these, and other obvious considerations, must be carefully considered by any one who attempts a fair estimate of the work which the Lick observatory is destined to accomplish. While it appears that the institution will be in a strong position to conduct and maintain a good degree of astronomical research with its own resources, there will be abundant field for prudent financiering in the management of its practical affairs. However, when the trustees are ready to resign the control of the observatory, the character of its instrumental and other equipment will be such that all increase of its permanent income, derivable from outside sources, will be wholly available for the pursuit of new and interesting lines of research. The nature of investigations of this sort enables the astronomer to make successful appeal for the funds necessary to carry them on; and the trustees have wisely refrained from equipping the observatory with any instruments and apparatus which will

not be of immediate necessity in the conservative lines of astronomical inquiry.

DAVID P. TODD.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

A method for determining the unit of light.

IN all photometric work hitherto undertaken, one of the main difficulties has been to obtain a satisfactory standard of light, — one which will be always constant, and which can be accurately duplicated. Heretofore, all experiments in this direction have been failures. The plan here suggested contemplates, not the employment of a unit quantity of light, but the employment of a certain effect produced by that unit quantity as a standard. In other words, it makes not the light, but the photometer, the constant.

This photometer must, then, be some device for measuring radiant energy. But, for photometric purposes, we wish only to measure that portion of the energy which has a wave-length readily visible to the human eye. With the great differences in color of our modern sources of illumination, it is absolutely impossible to state an exact equivalence between the yellow light of a candle-flame, and the blue light of an electric arc. For really accurate work, we can compare only light rays of the same wave-length. As the human eye is most sensitive to light from that portion of the spectrum between the *D* and *E* lines, in the following plan I have selected that region of the spectrum to be used exclusively for the comparison of the brilliancy of the various lights. In all probability, the total brilliancy of an incandescent body does not increase in a ratio exactly proportional to the increase in brilliancy of the yellow rays; but this difference, within practicable limits, is probably so small as to be entirely negligable. And we have the advantage of being able to state an accurate arithmetical ratio between the lights, instead of what must be at best a mere general comparison of the relative effect of the two lights upon our eyes.

Briefly stated, then, the method I would suggest consists in moving the light to be measured towards the slit of a spectroscope, until a certain effect is produced upon a screen so placed as to receive the yellow rays. When this effect is produced, the spectroscope is receiving the standard amount of light from the source; and the brilliancy of the source can then be determined by measuring its distance from the slit.

In attempting to apply this method, the difficulty which at first arises is, to obtain an effect which can be measured with accuracy. By permitting the spectrum of a light to fall upon suitable screens, three classes of effects may be obtained; namely, heating, visual, and chemical. Of these, the second is evidently unsuited for the purpose of obtaining a standard. The third is too uncertain, and not susceptible of sufficient accuracy, so that the first alone remains. Of the two practicable heat methods of measuring radiant energy, the thermopile is the more sensitive; but the bolometer responds the quicker to changes of temperature, and has the narrower surface. The latter instrument has, therefore, been selected for this application of the method. The unexposed arm of the bolometer has a slight additional adjustable resistance thrown into its circuit, so that, when the instrument is not in use, the needle of the galvonometer will have a certain deflection dependent on the strength of the battery-current employed. When the light to be measured is placed in front of the slit of the spectroscope (which should be quite broad), the deflection will be diminished. As the light approaches the slit, the deflection will decrease, and finally become zero, at which time it is giving out the standard light. Its brilliancy can now be read off from its position upon a scale placed in front of the slit and parallel to the collimator.

This photometer might also be used to adjust the position at which an incandescent electric or other lamp should be placed in order to furnish a constant supply of light. This source could then be used as a unit in an ordinary photometer.

WM. H. PICKERING.

An American Silurian scorpion.

The 'American scorpion' from the water-lime group of New-York State, described by Professor Whitfield on pp. 87, 88, is undoubtedly a young specimen of Eusarcus scorpionis (Grote and Pitt: Bulletin of the Buffalo society of natural sciences, vol. iii., pp. 1, 2), so named by an error, and which will be redescribed as Eurypterus scorpionis in the forthcoming vol. v. of the society's bulletin.

The enclosed is a sketch of the youngest specimen in my possession, drawn full size: the largest I have,

indicates an animal at least three feet long. There cannot be any doubt as to its zoölogical position; for the characteristics of the genus Eurypterus — eyes placed within the margin of the carapace, and a triangular spine as caudal appendage — can be distinctly identified.

All my specimens have been found in the water-lime group at Buffalo, associated with Eurypterus, Pterygotus, and Ceratiocaris. JULIUS POHLMAN.

Buffalo, N.Y., Aug. 5.

Of course it would be rather hazardous for me to say that the American scorpion, described in a former number of *Science*, was not the young of Eusarcus scorpionis (Grote and Pitt), in as positive language as Mr. Julius Pohlman says it is; for our knowledge of the embryonic features and development of the Eurypteridae is yet too little to allow of many positive assertions, where not accompanied by absolute evidence. Still I must say that I do not believe it to be the young of that or any other Eurypterid. The form of the limbs, the existence of the nipper-shaped palpus and of an apparently true mandible, resembling so much those of the Scorpionidae, are features which we should scarcely look for in an embryonic or undeveloped form of Eurypterus. If Mr. J. Pohlman had seen the photographs of the specimen instead of the rude cut, or had examined the specimen itself, I think he would have expressed a very different opinion.

R. P. Whitfield.

The geology of natural gas.

I do not wish to enter into a further discussion of the interesting question of the geology of natural gas, in anticipation of the results of a special investigation which has just been commenced in the oil and gas regions by Mr. John F. Carll for the State geological survey, but, in reply to Prof. I. C. White's criticism of my letter on this subject, I desire to state a few facts in support of my conclusion, that the 'anticlinal theory' alone is insufficient to account for the existence of natural gas, in all localities in the Pennsylvania and adjoining gas regions. In order to clearly understand this communication, reference should be made to *Science*, June 26 and July 17.

In the first place, it is important to know that the general statements contained both here and in my letter of July 17, refer, not only to all the gas regions of Pennsylvania which, with possibly the exception of the Erie district, are geologically connected with the oil-fields, but also to those other gas localities in New York, Ohio, and West Virginia which are not in the vicinity of producing oil-wells. The facts relating to the geology of natural gas, now in the possession of any one geologist, are not sufficiently numerous or connected to permit of the deduction of any ultimate theory; and it is only possible, for the present, to deduce special geotectonic conditions under which natural gas has so far been exploited. Some of these conditions are so varying and apparently antagonistic, that it is only possible to differentiate any one of the general laws controlling the occurrence of natural gas by a comparison of the individual facts obtained from innumerable well-drillings.

The facts given here will serve to elucidate my previous article, and I hope will prove to be sufficient to clearly define the few conclusions at which I have arrived, from field observations extending over a period of ten years, and from numerous studies in conjunction with Mr. Carll, of the results of his surveys, which are more thorough, complete, and valuable than any examinations which have ever been made bearing on the geology of both petroleum and natural gas.

The general structure of the strata drilled through by the gas-wells in the vicinity of Pittsburgh) now considered the most important gas district) is the same as that of the strata in the different parts of the Devonian and carboniferous series pierced by the oil-wells at the Smith's Ferry (30 miles N. 60° W. from Pittsburg) and the Slippery Rock (34 miles N. 20° W. from Pittsburgh) districts, where in both districts heavy oil is obtained from the base of the coal measures, and amber oil from the Berea grit; in the Thorn Creek (25 miles N. 5° E. from Pittsburgh), and south end of the Clarion, Butler, and Armstrong (28 miles N. 20° E. from Pittsburgh) districts, where oil is obtained from the Venango (Devonian) sands; and in the Pleasant Unity (30 miles S. 65° E. from Pittsburgh), Dunlap Creek (31 miles S. 12° E. from Pittsburgh), Whiteley Creek (45 miles S. from Pittsburgh), and Dunkard Creek (48 miles S. from Pittsburgh) districts, where oil is obtained from the Mahoning sandstone (lower barren coal measures) and overlying strata. The discovery of oil at Mount Nebo, about eight miles north-west of Pittsburgh, and the several small oil-wells reported to have been obtained in close proximity to the Washington (Chartiers Creek) gas-wells, together with traces of oil found upon special examination in the gas from wells which are supposed to produce absolutely dry gas (the gas obtained from the Carpenter well on the Daum farm, Westmoreland county, was supposed to be free from oil or water: when, however, the gas was confined under a pressure of a hundred and sixty pounds to the square inch, water was precipitated), the existence of natural gas, either in or near *all* the productive oil-pools, under geological and physical conditions similar to those found to obtain in what are frequently spoken of as 'natural-gas regions proper,' are all sufficient reasons for considering the districts producing either oil or gas exclusively (?) one in a geological sense.

Gas-wells are not entirely confined to narrow belts (one-fourth to one mile wide) along the crests of anticlinal folds, nor are those which have apparently been found in synclines necessarily in the vicinity of subordinate crumples or anticlinal rolls which are so frequently found in extensive basins. The "dip of the gas-sand and the position of the anticlines and synclines" is the third of the five principal geological and physical conditions, which I have already enumerated (*Science*, July 17), which seem to influence the occurrence of natural gas, and in special cases would seem to be the most important consideration. Most of the saddles and basins in western Pennsylvania have a progressive dip along their axial line toward the south-west; and a well, drilled half a mile to the north-west or south-east of a given point on the crest of an anticline, will encounter any given stratum at the same elevation as a well drilled immediately on the crest of the same anticline at a distance south-west from the given point, the distance in each case being dependent upon the intensity of the dip in the three directions. The anticline along which the famous Murraysville gas-wells in Westmoreland county have been drilled is an instance.

About ten miles north-east of the village of Murraysville, two large gas-wells have been obtained about three miles apart (north-west and south-east), one on Beaver Run, the other on Pine Run. The total dip of the Upper Freeport coal-bed, from the Beaver-run well to the Pine-run well, is two hundred and fifteen feet, or at the rate of seventy feet per mile toward the north-west. The former well is found in close proximity to the anticlinal axis along which the great Murraysville wells are obtained, farther to the south-west; while the latter well is near the synclinal axis. The extension of the general direction of this anticlinal line to the north-east of the Beaver-run well crosses the Conemaugh River near the mouth of Roaring Run, where a well was drilled, evidently on account of the existence of the anticline at that point; but no gas was found. The Apollo well, about three miles north-east of the Pine-run well, along a line parallel to the structural lines of the district, found no gas. In the

case of the Roaring Run and Apollo wells, it may be possible that no porous stratum, which could serve as a gas reservoir, was pierced by the drill: this, as already stated (*Science*, July 17), is the first necessary condition of the existence of gas.

The Ridgway gas-well is located in a syncline, and not on a subordinate anticline, as has been suggested, but at a point where there is a certain regular dip of about 1° toward the west, on the side of the syncline. The Kane gas-wells — including the large one at Kane, which is now supplying the residents of the town with light and fuel, and the famous Kane geyser (gas) well — are both in a syncline, the south-east dip, in the one case, and the north-west dip, in the other case, toward the centre of the basin, being less than fifty feet per mile; and the south-west dip along the axis of the basin being from fifteen to twenty-five feet per mile. The great McMullen & Hallet gas-well, commonly known as the 'Mullen snorter,' is not in the vicinity of any anticline. The gas-sand at this well is nearly horizontal, having a dip of about eleven feet only in a direction S. 15° W.

The gas-wells found in the vicinity of the city of Erie are located in a region where no anticlines or synclines have been discovered. The dip of the rocks here is toward the south-west, at the rate of about twenty feet per mile, from recent surveys: or from the surveys made nearly fifty years ago, by the First geological survey, as pointed out by Professor Lesley, the average dip was estimated to be fourteen feet per mile. Gas-wells have been drilled in the vicinity of Fredonia, New York, one as early as 1821. Gas is still obtained here; and, as far as the structure has been made out, no anticlines exist in the vicinity of the Fredonia wells.

While these few facts would seem to be enough to show that all gas-wells, either in the vicinity of productive oil territory, or at considerable distances removed therefrom, are not necessarily in the vicinity of anticlines, many instances might be cited, particularly in the gas regions recently developed in Pennsylvania, to show that some of the largest and most productive wells are either on or in the vicinity of anticlinal crests. I am free to admit, as I have already done, that the position of anticlines and synclines have an important bearing upon the location of profitable gas-wells; but I cannot believe that, in view of our present knowledge, the 'anticlinal theory' is sufficient to account for all occurrences of natural gas. As to whether it will be possible for facts still to be recorded to give any geologist an adequate basis for the formulation of an ultimate theory, we must await the results of Mr. Carll's present investigation.

CHAS. A. ASHBURNER,
Geologist in charge Penn. surv.

907 Walnut Street, Philadelphia,
Aug. 24.

Annuaire géologique universel.

The undersigned being mentioned, under the name of Dr. *Svedonius*, amongst the collaborators in the above-named work recently published by Dr. Dagincourt in Paris, and two articles on Sweden and Norway appearing in the same, signed in my name, of which I had no knowledge *until after* their publication, I do hereby declare that the said articles are not composed by me, but are uncritically compiled from two pamphlets printed in the years 1874 and 1878, and are, consequently, now substantially antiquated pamphlets, with the authorship of which I had nothing whatever to do. These pamphlets, together with several others on the same subject, I have, at the request of a Swedish man of science, forwarded to Dr. Dagincourt, emphatically pointing out the time of their publication; and to this my collaboratorship in the annual is restricted.

DR. F. SVENONIUS,
State geologist.

Stockholm, July 31.

Probable period of gestation in the 'horned toad.'

On the 15th of May last I captured a very fine specimen of an adult female Phrynosoma Douglassii. The fact having long been known to me that these reptiles are capable of sustaining prolonged fasts without any apparent inconvenience, I determined to test the question for my own satisfaction and information. Accordingly, this specimen was placed where it was impossible for it to secure any food. One month after its incarceration it was taken out to be examined. No particular change was noticeable; the barest traces of emaciation could be seen in the limbs; but the creature upon being teased puffed itself up, as they do, and made short leaps with open mouth at my finger. It also ran nimbly about my study.

It was replaced in its limited quarters, and another month passed by without its having taken a particle of nutriment. Its eyes now had a slight sunken appearance, and some shrinkage of the limbs could be detected. I dipped it in water for a moment, and once more introduced it to its narrow prison. At this stage of the proceedings my chief surprise arose from the fact that the body of the animal still retained its rotund contour, and was, if any thing, plumper than at the time of the inauguration of the experiment.

Upon this date it had passed no excrementitious matter for nearly three weeks.

My surprise was great, when, in looking into the box on the afternoon of the 10th of the present month, to find strewed about the bottom of it no less than seven newly-born young. These were all dead, and enveloped in their membranes, which latter also enclosed a bright yellow yelk about as large as a small pea. At the time, circumstances prevented me from making any further examination; but, two hours later, my astonishment was at its pitch, when I found *fourteen* more young had come to light. Two of these were without the membranes and yelk, but every one of the twenty-one was dead.

Upon examining the mother, it was at once evident that her labor had not terminated; and, indeed, within the next ten minutes she was delivered of three more young ones. These were all born tail first: two of them were living, and had to be simply freed from their envelopes, the yelks having been absorbed. The remaining one was like the majority of the others, and lived but a moment or two.

As I write these lines I have before me twenty-two of the young in alcohol, two live and active little fellows of the same brood, and the mother-lizard, who, though she has lost much of her original activity and flesh during her *three months'* test, looks for all the world as fully capable of enduring many more days of it.

Taking all the circumstances I have related into consideration, I believe it will be found that about one hundred days is the period of gestation of this viviparous reptile.

It will be of interest to state, in the present connection, that other lizards endure these fasts as well as Phrynosoma; for I have a large Sceloporus, un-

dergoing the test, that has suffered but very little, not having partaken of any food whatever for over a month.

I had a live Sceloporus consobrinus about my room here nearly two months, but one day it was missed, and ten days afterwards it was found in a dark corner. Nothing remained of it but the skin, enclosing a perfect skeleton and seven eggs. These latter had firm white shells, and were each of an elliptical form.

R. W. Shufeldt.

Fort Wingate, N. Mex., Aug. 12.

Color and other associations.

In the matter of color association with months, I have a relative who associates June and green, October and light crimson, December and blue.

I have strong color association with certain names; for example, —

Henry, Henrietta	= grass-green.
Sophia,	= dark green.
Louise,	= violet.
Charlotte,	= deep purple.
Alice,	= black and gold.
Francis,	= white and gold.
Emily,	= primrose-yellow.
Susan,	= pale blue.
Lucy,	= clear blue.
Anna,	= gold color.
Caroline,	= Naples-yellow.
Agnes,	= pearl gray.
Frances,	= pale fawn.
Lydia,	= a gay plaid, pink and green predominant.

Some of these, I suspect, are caused by the vowel in the name of the color and the proper name being the same. Lydia, perhaps, may wear the dress of the first owner of the name I ever saw. The others I cannot account for.

The months stand in a circle: December, January, and February grouped close together on the upper, or right hand; March and April curve around; May has a little more room; June, July, August, and September are wider apart; October and November correspond to March and April on the other side. The winter months are in the shade; the summer ones in a strong light.

F. M. Slack.

THE LICK OBSERVATORY.

To German parents in Lebanon county, Penn., in the year 1796, was born a son, who received the name James Lick. As a boy, he learned the piano-maker's trade in Philadelphia, where, in youth and early manhood, he led a varied life, engaging in divers occupations, from the making and selling of furniture and pianos, to the managing of a theatre. When about thirty-five years old, he went to South America, where he resided chiefly at Buenos Aires, acquiring property to the extent of about forty-five thousand dollars, with which sum, in 1847, he emigrated to the site of the present San Francisco, and invested it in real estate. In a quarter of a century he found himself worth a fortune nearly one hundred times as great, which, by the execution of a deed of trust, he placed under the control of a board of trustees, of which Mr. Richard S. Floyd is now the president.

Mr. Lick died at the age of eighty years. His chief scientific bequest was the sum of seven hundred thousand dollars, for the erection of a great observatory at a mountain elevation. He was anxious to secure the highest elevation consistent with ready accessibility; and Lake Tahoe, nearly eight thousand feet above sea-level, was about the first site which came prominently to his notice. The proposed locality was visited, investigated, and rejected; and the site of Mount Saint Helena, an eminence much nearer San Francisco, was visited by Mr. Lick in person. Early in 1875 Mr. Thomas E. Fraser suggested Mount Hamilton, in the county of Santa Clara, as a desirable site; and, on his recommendation, Mr. Lick decided upon this eminence for the permanent location of the great observatory. Mount Hamilton is situate in the Pacific coast-range, about fifty miles south-east of San Francisco, and thirteen miles in a direct line from San José, the nearest city. A telephone-line, and an excellent mountain road, now connect the two.

Mount Hamilton has a treble-pointed summit, about forty-five hundred feet high; and no mountain within a radius of one hundred miles approaches this elevation. The two extreme peaks of the general summit are nearly a mile distant from each other, in a north-east, south-west direction. The southernmost peak is bare of all woody growth, and its lines converge to form an angle slightly acute. Although about a hundred and twenty-five feet lower than the northern summit, this peak was chosen by the trustees for the location of the observatory, on the advice of Professor Newcomb and Mr. Burnham; as it presented the greater advantage in point of accessibility, configuration, and a minimum of obstruction to the view south, east, and west. The first work was to cut down this apex; and about forty-five thousand tons of rocks were removed, leaving an irregularly oval plateau, about four hundred and fifty feet in length, and with an extreme breadth of about two hundred and twenty-five feet. The lands about the mountain, which are set aside for observatory purposes, comprise a government reservation of about fifteen hundred acres, to which the trustees have added a hundred and sixty acres by purchase.

The first astronomer who visited the site of the projected observatory was Mr. Sherburne

W. Burnham, who in the autumn of 1879, on the recommendation of Professor Holden and Professor Newcomb, was invited by the Lick trustees to make a systematic study of the suitableness of the atmospheric conditions for observational research. In October he was joined by Professor Newcomb, who remained for a few days upon the summit, to advise with regard to the proper location of the buildings and instruments. Mr. Burnham devoted two months' time to the measurement of close double stars. During the period, Aug. 17 to Oct. 16 inclusive, he found, —

First-class nights, 42; medium nights, 7; cloudy and foggy nights, 11.

The summer of 1881 marked great progress. The transit of Mercury in the latter part of that year was observed with the twelve-inch equatorial and the four-inch meridian transit instrument in their permanent quarters, Professor Holden and Mr. Burnham securing complete series of satisfactory contact-observations. During the period Oct. 20 to Nov. 9, Professor Holden found fourteen nights which were perfectly clear, with at least average conditions of vision; and one of them was exceptionally fine.[1]

In the summer of 1882 the results achieved on the mountain were even more important than during the year previous. The construc-

FIG. 1. — THE LICK OBSERVATORY. DISTANT VIEW FROM THE NORTH-EAST.

There was not in the whole time a single poor night when it was clear.

In the spring of 1880 Capt. Floyd spent several weeks in Washington, accompanied by Mr. Fraser, whom the trustees had appointed superintendent of construction of the observatory. There they were in daily consultation with Professor Newcomb, Professor Holden, and other astronomers, with regard to the plans of construction on the mountain, and the final instrumental equipment of the institution. Under their direction, the architect's plans for the main building were prepared at this time, and the work of construction was at once begun.

tion of the main building was rapidly carried forward, and the problem of water-supply for all future purposes was shown to be effectively solved. Springs of excellent water had been discovered about four hundred feet below the summit, and a reservoir large enough to hold eighty-five thousand gallons was built on the apex of the middle peak. A year later, the trustees took the additional precaution of providing a second reservoir of nearly seventy thousand gallons capacity, in which the rains are collected from the slate roofs on Observa-

[1] It is to be remembered that this was at the season of the year when the change from the summer to the rainy season was impending, and when the inequality of the temperature between the day and the night was something near the maximum.

tory peak, and stored for use at the houses and stables just below.

As Mr. Lick gave specific direction that the income from his endowment of the observatory should be made 'useful in promoting science,' his trustees wisely made thorough provision for observing the transit of Venus of 1882. A photoheliograph, for obtaining very accurate pictures of the sun, was added to the permanent equipment of the observatory, for the purpose of co-operating with the American transit-of-Venus commission. The president of the trustees invited Professor Todd to direct the observations on Mount Hamilton; and the excellence of the photographs obtained by the expedition is largely due to the wide experience of his photographer-in-chief, Mr. Lovell of Amherst. The work of the expedition has been fully described in *Science*, vol. i. p. 94; and the results obtained from these photographs have been incorporated with those secured under the immediate direction of the American commission. The period of residence of the party on the mountain (Nov. 21 to Dec. 21) included four nights totally cloudy, fourteen partly cloudy, six clear with good seeing, and seven clear with exceptionally fine conditions of vision. The solar eclipse of the 16th March, 1885, was also photographed at the observatory, under very favorable atmospheric conditions.

The illustration of the ground-plan of Observatory peak shows the exact location of all the buildings on the main plateau, and the arrangements of the rooms of the principal edifice. This is mostly a single story high; and like all the other buildings containing instruments, and the dwelling-house also, is fire-proof in construction. The interior finish of the main building is of superior quality throughout: the hall, about two hundred feet in length, with its floor and wainscot of marble, affords an excellent space for optical experiments. The diagram shows also the position at the extreme south end of the plateau, which will ultimately be occupied by the great telescope.

Among the principal instruments of the observatory is the Repsold meridian-circle. Its object-glasses are six-and-one-third inches in diameter, and were made by the Clarks. A house of unusual construction and proportions (at the left of the square tower in the centre of the 'near view,' fig. 3) has been built to shelter this instrument. The building is forty-three feet by forty-five, with an office-wing adjoining. It has double walls, the interior of wood, and the exterior of iron, with abundant space between for ready access to any part; and the arrangements for securing the same temperature within as without are perfect. The shutters closing the observing-slit are of a novel pattern, the device of Mr. Fraser. The interior of the observing-room is of California red-wood with a high finish. At the right, in the illustra-

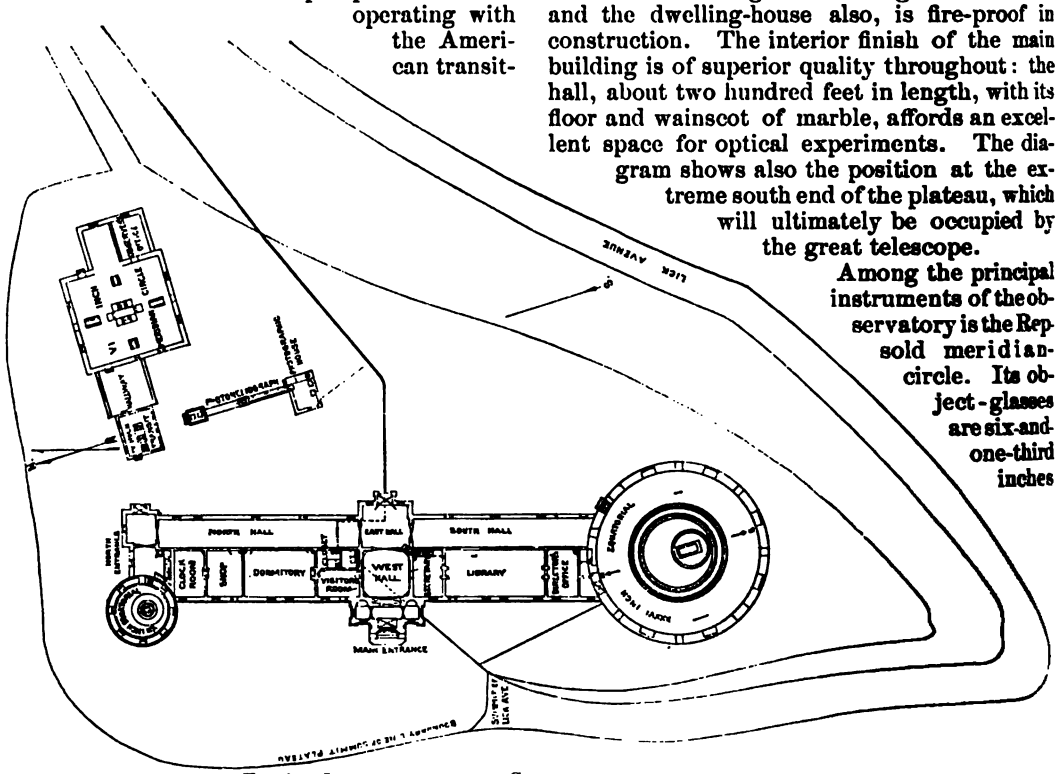


Fig. 2. — Lick observatory. Ground plan and summit plateau.

tion of this interior (fig. 4), is shown a covered carriage on rails, which serves the purpose of additional protection to the instrument when not in use.

At the centre of the 'near view' (fig. 3), is shown the permanent dwelling for the director of the observatory and his colleagues. It is built of brick, just below the observatory plateau, and faces the north-east, with a frontage of fifty feet. It contains thirty rooms, and extends toward the mountain to a depth of sixty feet; and a short bridge from the third story of the house lands on the summit plateau, near the entrance to the meridian-circle room.

It will be seen that the observatory is already in a position, so far as the outfit of the establishment is concerned, to proceed at once with astronomical research. In addition to the instruments already mentioned, its equipment consists of a four-inch transit-instrument by Fauth; a four-inch comet-seeker by Clark; a measuring-engine by Stackpole, reading either rectangular or polar co-ordinates; five clocks by Dent, Frodsham, Hohwü, and Howard, and four chronometers by Negus; a system of electric connections involving all the observing and clock rooms; a six and one-third inch equatorial telescope; a two-inch Repsold vertical circle; a workshop, with a complete outfit of lathes and tools; and an astronomical library containing a choice selection of works of an exclusively technical character. This latter has already necessitated an expense of about five thousand dollars.

Popular interest in the observatory now centres chiefly in the remaining work of the trustees, which is threefold, — the making of the object-glass of the great telescope; the construction of the mounting or mechanical portions of this instrument; and the building of the enormous dome, which will be required to cover the telescope, and permit its most unconstrained use. Upon the construction of the dome and the mounting, the future usefulness of the great telescope will very largely depend.

FIG. 3. — THE LICK OBSERVATORY. NEAR VIEW FROM THE NORTH-EAST.

The contract for the object-glass — amounting to about one-half the cost of the entire telescope — was placed with the Messrs. Clark nearly five years ago. Two years later they received from the glass-maker, Mr. Feil of Paris, a disk of flint-glass of the required perfection, and thirty-eight inches in diameter. This glass has already stood in their workshop at Cambridgeport nearly three years, and it is inexpedient for them to attempt to work it to the proper curvatures until its companion disk of crown-glass is secured: in fact, these curvatures cannot be definitely

decided upon until both disks have been carefully tested. The difficulties which the glass-maker has to encounter in obtaining so large a disk of crown-glass have been found to be much greater than with the flint, and fifteen or twenty moulds are said to have been ruined in the attempt to get them into the required disk-form. It is hoped that the glass-maker will succeed in accomplishing his task during the present season; and, in that event, the great telescope can readily be completed in 1887. Mr. Lick's trustees will then transfer the establishment to the University of California, and the observatory will subsequently be conducted under the control of the regents of that institution.

An inquiry often made, and a very natural and proper one, relates to the prospective capabilities of this enormous instrument, when mounted in so favorable an atmosphere, and directed to the moon. Every astronomer who has observed the heavenly bodies from Mount Hamilton knows that the extraordinary steadiness of the atmosphere enables him to regularly employ eye-pieces on his telescope which magnify two or three times as much as those he habitually uses for the same kinds of work at home. It is thus not unreasonable to expect that a few nights in the course of each observing-year may be found when the maximum magnifying-power — about thirty-five hundred diameters — may be advantageously employed on the great telescope. The theoretical distance of the moon would then become about sixty miles, but the corresponding ideal conditions of perfect vision can never be attained. Making due allowance for the unavoidable effects of the earth's atmosphere and other unfavorable conditions, the observer might expect to see the moon much the same as he would without the telescope if it were only a hundred miles away. If, at the same time, the moon happened to be at its least distance from the eye of the observer, — about 220,000 miles, — and if the object on the moon were suitably illumined by the sun's light, it is possible that details of its nature might be satisfactorily made out, even although they were no larger than some of the larger edifices on the earth.

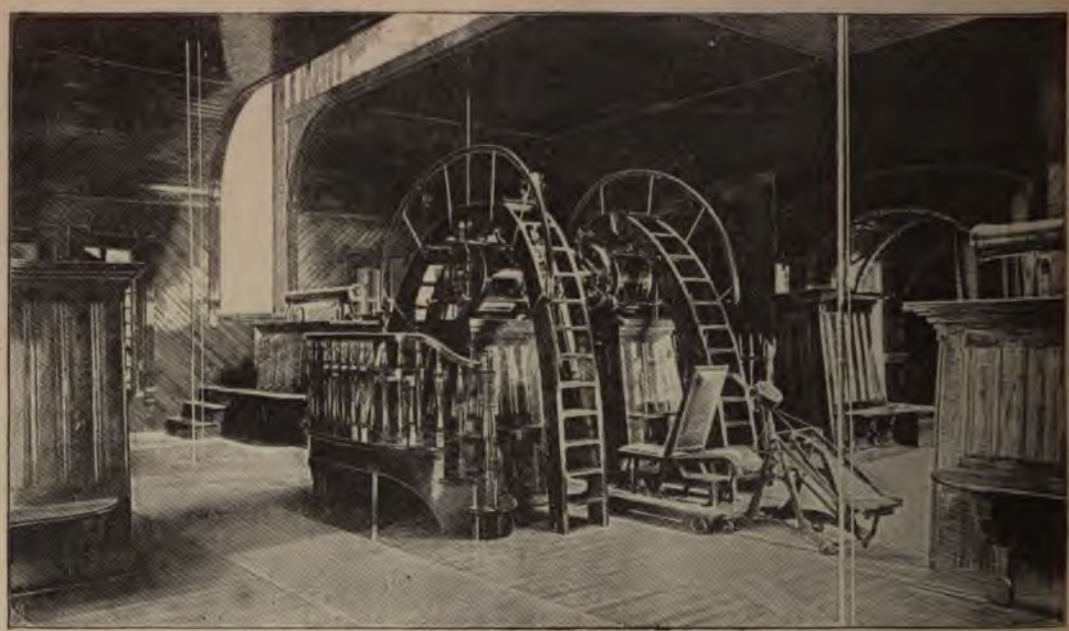


Fig. 4. — The Lick observatory. Interior of the meridian-circle house.

THE GROWTH OF THE FRENCH ACADEMY. 1635–1885.

It is interesting to trace the influences by which the French institute, *l'Institut de France*, as we know it in these days, has been developed from the French academy, *l'Académie*

française, of the days of Richelieu. The original society entered with enthusiasm upon a course marked out for it by the regulations of the founder. There was no precedent to be followed, no example to be imitated. The local academies in Italy may have suggested some of the statutes. The preparation of a standard dictionary, for example, may have been in imitation of the dictionary Della Crusca; but at that period, as now, the French liked to work in accordance with their own ideas of good method. Richelieu remained protector of the academy from 1635 until his death in 1642; and then, not Cardinal Mazarin, nor the prince of Condé, both of whom were thought of, but Séguier, already a member of the academy, and the chancellor of France, succeeded to the honor. When he died, the academy, which had grown up to the dignity projected for it by its illustrious founder, invited the king himself to become its patron; and the grand monarch did not hesitate to add this new jewel to his crown. He gratified the academicians by many tokens of royal favor, — for example, invitations to court entertainments, and a present of forty *fauteuils*, — and they flattered him with frequent acts of literary obsequiousness. To Louis XIV. as protector succeeded Louis XV. and Louis XVI.; and, when the monarchy fell in the revolution, the academy fell with it as if it were a royal council. When afterwards revived, it was in a humiliated form.

Two other academies were instituted in France soon after the French academy, — the Academy of inscriptions and belles-lettres, and the Academy of sciences; the first-named in 1663, and the other in 1666. There was also an Academy of painting founded in 1648; but it did not take rank with the others, and was subsequently reorganized as the Academy of fine arts. In the provinces also, — at Arles, Nismes, Soissons, Metz, and elsewhere, — local academies, based upon the model of the capital, grew up, and were (in many cases, if not in all) affiliated with one of the academies in Paris.

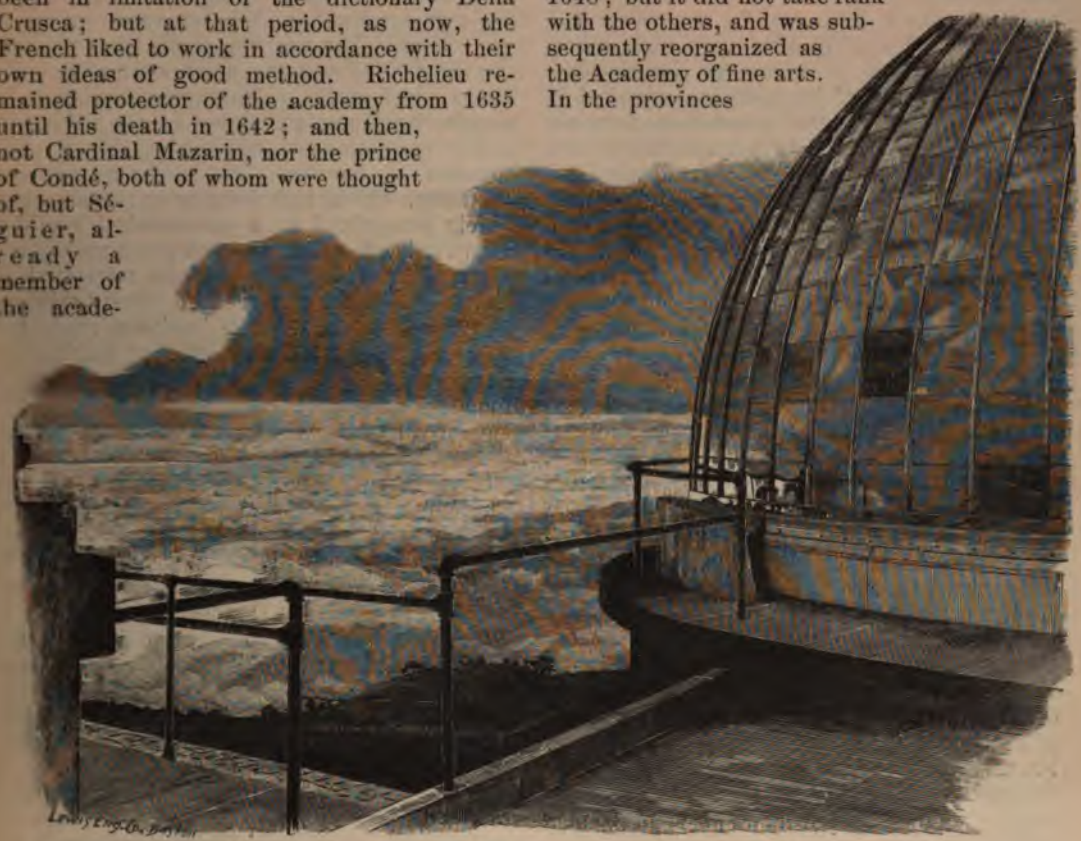


FIG. 5. — THE LICK OBSERVATORY. VIEW TO THE NORTH-WEST, "ABOVE THE CLOUDS."

The Academy of inscriptions and belles-lettres was at first only a section or committee of the French academy, — four of the members having been selected by the king to decide upon the proper forms to be observed in the legends which should be cut on medals, and in the inscriptions which should be put upon the monuments designed to perpetuate his honor. He fitly called it 'his little academy.'

Such atrocious pomposity can hardly be conceived of in our day as characterized the egoism of Louis XIV. Nevertheless, better things than he projected came from the association which he evoked for the purpose of devising inscriptions, mottoes, and medals, and for making suggestions in respect to royal *fêtes*, tapestries, and operas. The simple organization of 1663 was revised in 1701; and then, for a long period, associated and co-operative learning, of a very high order, distinguished the Academy of inscriptions. The first volume of its memoirs appeared in 1717; and before the revolution forty-six quarto volumes had been printed, embodying important historical and classical memoirs.

The Academy of sciences was founded in 1666, and reorganized in 1699. It has a history of its own so distinct from that of the French academy, and so illustrious, that we shall not attempt to give it in any subordinate paragraph.

The tragic days of the revolution swept good things as well as bad into the vortex. In August, 1793, the convention decreed that all academies and literary societies authorized (*patentées*) by the nation be suppressed. When the reign of terror was over, a reaction naturally came. The leaders of public opinion were ready to recognize the value of organized efforts for the promotion of knowledge; and the convention, two years after its abolition of the academies, established an *Institut national* for promoting discoveries, and for advancing the arts and sciences. This was in October, 1795. The new foundation was to be composed of a hundred and forty-four members resident in Paris, and a like number in other parts of France, together with twenty-four foreign associates. Three 'classes' were established,— the *first*, of mathematical and physical science, with ten sections, each of which had six Parisian and six departmental members; the *second*, of moral and political sciences, with six sections of the same number of members; and the *third*, of literature and the fine arts, divided into eight sections, each of six Parisian and six departmental members. The directory was to nominate forty-eight members from Paris; they were to select ninety-six more; and this company of one hundred and forty-four were to choose an equal number of colleagues from the departments. Subsequent legislation matured the regulations of the institute; but in 1803, Napoleon, then first consul, gave them a thorough overhauling. For three classes, he substituted four. That of moral and political sciences, to which he seemed to owe a grudge, was abolished. The old French academy, which had almost disappeared in the 'section of grammar,' now reappeared as the second class of the new institute, and the academy of sciences became the first class. History and ancient literature, representing the old academy of inscriptions, gave the name to the third class, and the fourth was that of the fine arts. Here substantially were the four academies of the monarchy united in one bond. The second class, representing the *Académie française*, was restricted to forty chairs; and twelve of the occupants might be chosen from the other classes of the institute.

The reaction went still farther, on the restoration of royalty. In 1816 the French academy, which had been suppressed, then barely recognized as a grammatical section, afterwards allowed the second place among the classes of the institute, was now reinstated in its true position, and recalled by its original and honored name. The institute, reads the new decree, shall consist of four academies, named as follows, and in the order of their foundation, — the French academy, the academy royal of inscriptions and belles-lettres, the academy royal of sciences, and the academy royal of fine arts. Members of any academy are eligible to the three others. The French academy resumes its former statutes. It was not until sixteen years later, in 1832, that the academy of moral and political sciences was reinstated under the ministry of Guizot. The second empire modified in some details the regulations of the Institut; and the new republic in 1872 removed these imperial modifications, and restored the former statutes, under which the institute of France is now organized with its five academies.

We have thus traced in outline the growth of the French academy during two centuries and a half. A private club employs such excellent methods of associated criticism, that it is recognized by the state, and made an important public agency for the promotion of letters. Kindred associations are formed upon its model. It grows so steadily in importance, that at length three kings successively assume its protection. When the crown falls in the days of anarchy, the academy and its sisters are suppressed. As order is restored to the state, the institute of France rises from the ashes, hiding in its organization the faint remembrance of the academy. Presently the old organization is distinctly recognized, but without its name and without the precedence which is its birthright. The next step is to re-establish it, with its earliest designation, as

first in the group of five academies, by which, under the name of the *Institut*, the people of France provide for the preservation and improvement of their language, for the promotion of history, for the advancement of science, for the encouragement of art, and for the establishment of just ideas in morals and politics.

THE SOCIETY FOR THE PROMOTION OF AGRICULTURAL SCIENCE.

THE sixth annual meeting of this society at Ann Arbor, Aug. 25, may fairly be said to have been the best of the number, whether as regards the attendance of members and others, the number and character of the papers read, or the general interest and profit of the discussions.

The meeting was opened on Tuesday morning by a paper from Mr. J. J. Thomas of New York, upon 'The influence of locality upon varieties of fruit,' in which the author opposed the opinion which has been advanced by eminent pomologists, that varieties of fruit raised on our own soil and in our own localities are, on that account, better suited to this country. As regards pears, fully half our varieties are of foreign origin; and very many of these are among our most esteemed varieties, notably the Bartlett, and can hardly be equalled by the same number of native varieties. In the case of the apple, while many good varieties are of foreign origin, this fruit has been so extensively and successfully cultivated in America that our best varieties have come to be those of native origin. At the same time, most of the esteemed western and southern varieties are of eastern origin. The apple is very susceptible to influences of locality during the growth and ripening of the fruit; and this fact, rather than any differences due to origin, accounts for the preference shown for different varieties in different regions.

In the discussion following the paper, attention was called by Dr. E. L. Sturtevant to what appears to be the fact, that well-ripened specimens of any fruit are of the highest flavor in the most northern localities, while the size and appearance usually improve as one goes southward; and he suggested as a possible explanation the influence of actinism. During the growing season, plants receive more hours of sunlight in northern than in southern localities; and it is possible that this has something to do with their higher flavor. The subject is an important one for investigation. He also described a simple and inexpensive apparatus for automatically recording the number of hours of sunlight daily, without reference to intensity. This apparatus is now in use at the N. Y. experiment station; and the U. S. signal service is considering its introduction at a number of stations, in the hope that a record of the hours of sunlight may at least show whether it is desirable to attack the much more difficult problem of measuring its actinic intensity.

Prof. W. J. Beal confirmed Dr. Sturtevant's statement as to the flavor of fruit from northern and southern localities as regards Michigan fruits. Mr. Crozier instanced an experiment in which flowers from the same seed grown in Paris and in Upsala were much brighter colored in the more northern locality. Prof. I. P. Roberts called attention to the fact, that the soil has also much to do with the flavor of apples, stating that about Ithaca, N.Y., the best apples were grown on a clay soil and in elevated localities.

Following Mr. Thomas's paper were two by Dr. E. L. Sturtevant of New York, upon the 'dandelion' and 'lettuce.' These papers were in support of the hypothesis that the form-species of cultivated plants are not originated by culture, but are really selections from wild types. Thus in Vilmorin, Andrieux et Cie's seed-catalogue, three distinct varieties of dandelion are figured. Upon the grounds of the N. Y. experiment station, there are to be found growing wild, under conditions which seemingly preclude the possibility of their being escapes from cultivation, dandelions corresponding very closely to these three varieties. Moreover, two of these three varieties are figured respectively by Anton Pinaeus in 1561, and by Dodonaeus in 1616.

If it be granted, upon this evidence, that the cultivated varieties of dandelion are simply selections from wild types, "it may be legitimately questioned whether other of our cultivated form-species in other plants are not likewise of natural origin. A careful investigation into the history of the origin of our cultivated varieties, fully justifies the statement that I have as yet secured no data which justify the belief that form-species in culture are other than of natural origin; and I have secured much evidence in favor of the view that form-species are introductions from natural variations."

The paper upon lettuce is in further confirmation of this hypothesis. It should be said, however, that the author expressly recognizes the fact that much further study is necessary before so radical a belief can receive countenance.

In the ensuing discussion, Professor Bailey called attention to the fact that variable wild plants are those most likely to be selected for improvement, as to a certain extent sustaining the hypothesis advanced in the papers.

The afternoon session was opened by a paper upon 'The demands made by agriculture upon the science of botany,' by Prof. C. E. Bessey of Nebraska. The paper was devoted to the subject of the teaching of botany in colleges; and the writer made an earnest plea for the more extensive and thorough study of this science, classifying the demands made upon it by agriculture under three heads: First, a nomenclature and classification of the plants of the farm, cultivated as well as wild. Second, a better knowledge of the physiology of plants, including such subjects as growth and nutrition, fertilization, heredity, and the physiology of cultivation and improvement. Third, a better knowledge of the pathology of plants, particularly of that ill-defined state known as 'lowered vitality.'

Several speakers following Professor Bessey, commended the sentiments of his paper, and deprecated the undue attention given to systematic botany in many cases, where the chief end of the study seems to be to enable the student to find out the technical name of the plant.

A paper by Prof. T. J. Burrill of Illinois, upon 'An experiment in silk-culture,' came next upon the programme. The experiment was but very partially successful as regards the production of silk, the larger part of the worms dying of a contagious disease at about the time when they should have formed cocoons. The investigation of this disease formed the main subject of the paper. The disease was identified by the author, and by Professor Forbes, with the *flacherie* of Pasteur, and was plainly not the disease which he describes under the name *pébrine*. It also appears to be identical with a disease which has lately proved very fatal to the larvae of the cabbage butterfly.

The writer was not aware that any one had previously positively determined the existence of true *flacherie*, or of *pébrine* in America; but, if the conclusions of his paper were correct, the former, at least, has, in all probability, long existed here unrecognized.

In remarking upon the above papers, Prof. C. V. Riley claimed that both these diseases of the silkworm had been recognized by entomologists in this country, though they had not been able to give the disease that careful microscopical and bacteriological study which Professors Burrill and Forbes had done. He also stated his belief that the germs of *flacherie* are omnipresent, and that the disease may be induced at any time by unsanitary conditions.

A paper followed by Major Henry E. Alvord of New York, upon 'Telemetric aid to meteorological records,' describing briefly an apparatus made by the Telethermometer company of New-York city, by which a continuous record of temperature can be obtained at any reasonable distance from the place of observation, and with very little trouble. The results of about six months' comparison of one of these instruments, with thirteen daily readings of a standard mercurial thermometer, showed a tolerably close agreement between the two. The telethermometer was slightly tardy in its changes, and usually failed markedly to reach the minimum daily temperature, and frequently fell a little short of the maximum. The author considered it — though by no means perfect — to be the best aid yet found for recording atmospheric temperatures in connection with agricultural studies.

The next paper was by Prof. H. P. Armsby of Wisconsin, upon 'The creaming of milk by the Cooley system.' It was chiefly statistical, giving the results of some two hundred and fifty experiments in creaming the milk of single cans by this system; and showing that in eleven hours 90–99 per cent of the fat of the milk was recovered in the cream, as against 75–80 per cent in some recently reported German experiments in which the temperature of the water surrounding the cans of milk was much higher. The experiments furnished also some hints as to further investigations upon the influence of small variations of temperature upon the process, but no definite conclusions.

A paper by Prof. G. C. Caldwell of New York, upon 'The lactobutyrometer,' consisted chiefly of a review of the tests of this instrument on record; but contained also some experiments as to the cause of the failure of the process in certain cases to extract even approximately all the fat from milk, particularly that from highly-fed cows. The author concludes that his experiments are at least not inconsistent with the belief that either an albuminous envelope, or some sort of an accumulation of albuminoid matter about the fat globules, gives rise to the difficulty.

A brief report by Prof. W. J. Beal, upon the progress of experiments on the vitality of buried seeds, and a short account by Prof. C. V. Riley of a new remedy for locusts, which has been successfully used in California, and the reading by title of a paper by Prof. E. W. Hilgard "On some redeeming traits of 'alkali' soils," closed the reading of papers.

At the business meeting, the following officers were elected for the ensuing year: President, Henry E. Alvord; secretary and treasurer, B. D. Halsted; executive committee, Henry E. Alvord, B. D. Halsted, and E. M. Shelton.

THE DEVELOPMENT OF THE EYE.

In a recent paper before the Philadelphia academy, Dr. Benjamin Sharp has endeavored to trace the development of the highly complex vertebrate eye from the simplest deposit of pigment in an epithelial cell. The simplest organ of vision is found in the Lamellibranchiata; but these are not the primitive organs of the group, the ancestral eyes being present in a few forms for a short time during the free larval stage. The most primitive adult eyes are found in the common oyster, in which the free edge of the mantle is lined with a number of epithelial cells (fig. 1) having a nucleus (*n*), a deposit of pigment (*p*), a transparent cuticula (*c*), with an undoubted power of vision. The next step of advance is illustrated in the common Venus, in which the eyes are confined to the most exposed part of the body, the so-called siphon. So far there has been no protection to the visual organs other than that afforded by the shell; but in Venus the fact that there are pigment cells at the base as well as on the extremities of the tentacles indicates a change soon o take place. This change is well shown in the razor-shell Solen (fig. 2), where all the eyes are arranged about the base of the tentacles, and, furthermore, are sunk into deep grooves. The organ is also much more perfect.

Fig. 1. — Visual cells of Ostrea virginica. *c*, cuticle; *p*, pigment; *n*, nucleus.

Fig. 2. — One visual cell of Solen vagina. *c*, cuticle; *p*, pigment; *n*, nucleus.

In the Gastropoda, from which the lamellibranchs have probably degenerated, the visual organs take

their morphological position at the oral end of the body; and, with only one or two exceptions, there is but a single pair of eyes. In Patella, the row of eyes last seen in Solen has become a simple sphere of pigmented cells; and in Haliotis we have also an open sphere, but, instead of the refractive cuticula in front of each cell, there is one combined mass forming a lens, which is purely a secretion, not cellular as in vertebrates. Fissurella goes practically as far as any gastropod, having a closed eye containing a lens, and a transparent epidermal covering acting as a cornea. Both Fissurella and Haliotis have a distinct nerve specialized for sight, which connects the eye with the superior cephalic ganglion.

In an early stage of the vertebrate embryo, the anterior medullary groove divides into three segments, — the fore, mid, and hind brain. The fore-brain sends outwards and laterally a swelling, which increases in size, and passes on to the epidermis; and here an invagination takes place to meet this outward brain-growth. This invagination finally closes, and soon becomes cut off, forming a hollow vesicle, the cavity of which is finally obliterated, and, becoming transparent, forms the lens of the adult eye. In the mean time the growth from the brain has arched over and above this vesicle; and then, folding over laterally, it encloses the lens (fig. 3), which fills up the anterior opening of the cavity of this 'secondary optic vesicle.' After the closure is completed by the union of *a* and *b*, there is a double-walled vesicle, the interior wall giving rise to the many layered retina, while the external wall forms the pigment layer of the choroidea.

FIG. 3.— Diagram to illustrate the method by which the secondary optic vesicle encloses the lens which should fill up the open end. Eye of vertebrate.

The evolution of this eye seems simple; for, as soon as it became of importance to its possessor, a corresponding stimulation took place in the brain, where sight is without doubt seated. An increase of development began all along the tract, from the lens to the brain; and, as this increased, that part of the brain nearest the eye enlarged, and proceeded by steps outward in a manner similar to the process now taking place in the development of the eyes of Vertebrata. We then have a stage in which a part of the brain closes over the superior part of the eye, being separated by a layer of fibres which is the much shortened and flattened primitive optic nerve. The pedicle connecting this advanced part of the brain, which may be looked upon as a ganglion, will now be called the 'secondary optic nerve,' — the optic nerve of the eyes of the adult Vertebrata. Dr. Sharp thus holds, 1°, that the lens of the vertebrate eye is homologous with a primitive invaginated eye, such as we find to-day in the gasteropods; 2°, that the layer of optic fibres of the retina is homologous with the primitive optic nerve.

In vertebrates as well as invertebrates we frequently find blind animals, the near relatives of which have well-developed organs of sight. In these cases the accessory organs are first to disappear, the lens first; and in the lowest forms of degeneration, Branchiostoma notably, nothing remains but a slight deposit of pigment on the anterior end of the neural canal. This deposit in Branchiostoma, and a similar deposit in some larval Ascidia, have led Lankester to regard the primitive type of Vertebrata as a transparent animal with eyes sessile in the brain; but Dr. Sharp's investigations have led him to the opinion that forms so degenerate as these should not be taken as a standard on which to base our conclusions in regard to the origin of the vertebrates.

CIVILIZATION AND EYESIGHT.

THE discussion following Lord Rayleigh's article upon 'Civilization and eyesight' (*Nature*, No. 798, p. 340) has resulted in a clear exposition of this interesting subject. Rayleigh is of the opinion that the supposed superiority of the savage eye is merely a question of attention, and practice in the interpretation of minute indications; and that it is comparable with the acuteness of the blind in drawing conclusions from slender acoustical premises. It is doubtful whether the blind can hear sounds wholly inaudible to others; and, likewise, it seems impossible for the savage eye, with practically the same aperture as the civilized eye, to resolve objects, beyond a certain point, calculable by the laws of optics from the wave-length of light.

J. Rand Capron (*Nature*, No. 799, p. 359) suggests that, in considering the question of aperture, the fact that this, though probably following a general rule applicable alike to savages and civilized beings, varies in individual cases, should be taken into account. He mentions an assistant who had a singularly 'sharp' eye, and could pick out with ease companions to double stars, small satellites, etc., which others saw with difficulty. The pupils of his eyes were always larger than those of most other persons; and he had the peculiar power of being able to read fine print with ease when the gas was turned half on, and it was his habitual custom to read in this way. He suggests that there must be something more than a mere 'question of attention and interpretation of minute details,' when a savage can resolve two distant dots into distinctly appreciable personages, as regards sex and garments.

R. Brudenell Carter urges (*Nature*, No. 800, p. 386) that there is no necessity for a larger aperture to explain acuteness of vision. The savage might have greater sensitiveness to variations of light, greater sensitiveness to color, and acuteness of vision over a larger retinal area. All these advantages might be conferred by better formation or higher development of the retina; and such higher development might at once be promoted by exercise, and handed down by descent. He believes that the conditions of town-life are unfavorable to the evolution, and favorable to the degradation, of the eye; and, further, that a mod-

erate amount of attention might greatly modify these conditions, and might do for the eyes what is done by athletic games and exercises for the muscles.

A still different explanation of the phenomenon is given by G. B. Buckton (*Nature*, No. 801, p. 407). The same amount of light entering the eyes of different individuals produces widely different effects, according to health or age. A student becoming accustomed to see objects from a short distance, will permanently accommodate himself to a short focus, and hence become short-sighted. Such modifications can be conceived of as being hereditary, and long-sight might be brought about in a race by the opposite use of the eye.

Apropos to this discussion, it may be well to notice briefly a discussion upon near-sightedness, which was started by Lord Rayleigh's article. The investigation of the question of the increasing prevalence of short-sight, which has recently been carried on in Germany, has led to legislative restrictions in the schools. The numerous statistics from the German schools have shown that the proportion of short-sighted boys continually increases from form to form; and from this fact it has been argued that the continued use of the eyes for the perception of near objects, is the essential, if not the only, factor in the production of short-sight. This view is again supported by the statistics, which allot the largest proportion of short-sighted individuals to those branches of industry, or those pursuits, which constantly call for near vision. In this connection, Mr. George A. Berry (*Nature*, No. 800, p. 387) suggests that two points have been forgotten in arriving at such a conclusion. In the first place, there is an undoubted tendency to grow short-sighted with age alone, up to the period of cessation of growth. This has been shown to be due to the elongation of the antero-posterior axis of the eye, and is no more a disease than is the attainment of more than an average height by certain individuals. It is merely a type; and, as such, is governed by the laws of heredity. A small proportion of cases are, however, due to disease; and these are as frequent among the illiterate as the educated, and are not hereditary. In many cases, people drift into literary and similar pursuits because they are near-sighted, and not well adapted for other occupations. Further, as a man's circle of acquaintance is, for the most part, amongst individuals having similar interests in life, intermarriage in myoptic families must frequently occur, and would tend to perpetuate, and perhaps increase, the defect. In savages, on the other hand, where the great principle of survival of the fittest is not frustrated to the same extent as among civilized races, every thing would be against the perpetuation of a myoptic type.

CHEYNE'S OBSERVATIONS ON THE CHOLERA MICROBE.

In connection with the work of Van Ermengem upon the cholera bacillus (*Science*, No. 133), that of Cheyne, recently published (*British med. journ.*, April 25–May 23, 1885), deserves attention. This gives the results of his investigations at Paris during the epidemic of cholera, and afterwards at his own laboratory. In eight cases investigated, he found the curved bacilli in larger or smaller numbers: in a ninth case, supposed to be cholera, but turning out not to be, no curved bacilli were found. He failed to demonstrate these bacilli in the walls of the intestines in almost all cases; and, when he succeeded in finding them at all, they were very indistinct. He very justly observes, however, that Koch may succeed in such a demonstration where others fail; for Koch's technique is unquestionably superior to that of any other worker in this field.

Having sent his slides and cultures to Koch, and having the latter's assurance that they were pure, and made up of the curved bacillus of Asiatic cholera, Cheyne made various experiments with them in culture-media of different kinds and at different temperatures, the results of all of which were in conformity with what was already known. In particular, he found no difficulty in repeating Koch's observation, that drying rapidly destroys the vitality of these organisms: 'in three hours they are completely dead.'

His conclusions are, that the comma bacillus was present, and generally in large numbers, in all the cases of cholera which were examined; and that he has never met with the cholera bacillus except in cholera, and that the other curved bacilli described (Finkler and Prior's, Lewis's, and Dencke's or Flügge's), differ from it in important particulars.

Inoculation experiments were performed on seventeen guinea-pigs, with successful results in only two. Two other animals died, but were not examined, because destroyed. (We would suggest greater care of his inoculated animals, for these misfortunes seem to be but a repetition of those that happened in this observer's work on tuberculosis; see *Practitioner*, April, 1883.)

The last part of Mr. Cheyne's article is devoted to an able refutation of Klein's arguments against the specific nature of the comma bacillus. He shows the hasty work of this observer, which has led him to conclusions so entirely at variance with those of Koch and his supporters. He (Cheyne) thus summarizes his opinion of the work of the English cholera commission: "The two errors which, in my opinion, lie at the root of the work of the English cholera commission are, first, that, acting on the idea that Koch diagnosed the cholera bacilli by the microscope alone, they proceeded to investigate the matter by microscopic examination; and, secondly, that, seeing the stress which Dr. Koch laid on the cultivation appearances, they concluded that he meant to say that the organism was pathogenic, because it grows in a particular manner: and, therefore, they naturally proceeded to inquire whether the appearance of the cultivations, as compared with cultivations of other bacteria, could warrant this conclusion; and, of course, they found that it could not."

MOSQUITOES VS. TROUT.

MR. C. H. MURRAY of Denver writes to Professor Baird the following letter, which we are permitted to print in advance of its publication by the U. S. fish commission: —

In the middle or latter part of June, — I think it was, — in 1882, I was prospecting on the head-waters of the Tumiche Creek in the Gunnison valley, Col. About nine o'clock in the morning, I sat down in the shade of some willows that skirted a clear but shallow place in the creek. In a quiet part of the water, where their movements were readily discernible, were some fresh-hatched brook or mountain trout; and circling about over the water was a small swarm of mosquitoes. The trout were very young, still having the pellucid sack puffing out from the region of the gills, with the rest of their body almost transparent when they would swim into a portion of the water that was lighted up by direct sunshine. Every few minutes these baby trout — for what purpose I do not know, unless to get the benefit of more air — would come to the surface of the water, so that the top of their head was level with the surface of the water. When this was the case, a mosquito would alight, and immediately transfix the trout by inserting his proboscis, or bill, into the brain of the fish, which seemed incapable of escaping. The mosquito would hold his victim steady until he had extracted all the life juices; and when this was accomplished, and he flew away, the dead trout would turn over on his back, and float down the stream. I was so interested in this before unheard of destruction of fish, that I watched the depredations of these mosquitoes for more than half an hour; and in that time over twenty trout were sucked dry, and their lifeless shells sent floating away with the current. It was the only occasion that I was ever witness to the fact, and I have been unable by inquiry to ascertain if others have observed a similar destruction of fish. I am sure the fish were trout, as the locality was quite near snow line, and the water very cold, and no other fish were in the stream at that altitude. From this observation, I am satisfied that great numbers of trout, and perhaps infant fish of other varieties in clear waters, must come to their death in this way; and, if the fact has not been heretofore recorded, it is important to those interested in pisciculture.

LAST YEAR'S MEETING OF THE AMERICAN ASSOCIATION.

THE proceedings of the American association for the advancement of science for 1884 were ready for publication only just prior to the date appointed for the meeting at Ann Arbor. They extend through 736 pages, to which there is an index covering sixteen pages. As usual, a large part of the papers are represented only by titles and abstracts, some others have already been printed; so that the volume is chiefly to be valued for reference, rather than for the freshness of its contents. It appears to have been carefully edited by the secretary, and to contain in exact and convenient forms all the general information respecting officers, membership, committees, and official acts to which we have been so long accustomed. Of course we cannot allude specifically to the long array of scientific communications here presented; but we will venture to call the attention of the general reader to the various addresses which he will find in the volume, and which, taken collectively, afford a very good insight into the aspect of scientific studies in this country and at this time.

A re-examination of the opening address of Prof. C. A. Young of Princeton, on the 'Pending problems in astronomy,' has confirmed our first impressions of its value. Indeed, we do not hesitate to call it a model discourse for such an occasion. The president of the association selected a theme which he was fully qualified to discuss, — one which enabled him to look forward as well as backward, one which was of equal interest to the astronomer and to the students of other sciences. The style in which he wrote was bright, and fitted to engage the attention of any well-educated person, while it remained free from all that was extraneous or sensational. No better introduction can be found to the present condition of astronomical science.

The addresses of the vice-presidents are also given. That of Professor Eddy is a complaint and an appeal, with respect to the neglect of mathematics by our countrymen, and recalls a like complaint which was made by Professor Newton when he was sectional vice-president a few years ago, and a well-known article by Professor Newcomb in the *North-American review* for 1874. It is difficult to account for the intellectual abstinence of Americans, to which these writers refer, from domains so inexhaustible as those of modern mathematics, except by remembering the eagerness of everybody in this land — scholars and teachers, as well as investors and merchants — for immediate results, — for the concrete rather than the abstract. Professor John Trowbridge entitles his address 'What is electricity?' — a question which he knows, as well as anybody, is easier asked than answered. Nevertheless, around this inquiry he has grouped a large number of important and suggestive statements, which were particularly appropriate at a time when the national electrical congress was about to meet in the city of Franklin. In

this address, and in that of Professor Eddy, the personal experience of the speaker is so introduced as to give a peculiar value to what is said. Professor Langley of Ann Arbor discusses 'Chemical affinity,' "the bud our science put forth in its alchemical stage," but a bud which of late appears to have withered. By an elaborate review he endeavors to show that "it is the word only which has become obsolete; the idea behind it is still active and of great importance." Professor Thurston, now of Cornell, takes a much broader theme, the 'Mission of science,' and naturally falls into a more rhetorical paper. In almost optimistic language he points out the value of applied science, and especially of mechanics as an aid to government in the promotion of social welfare. "The mission of science," he claims, "is to be fulfilled mainly through the application of mechanics." It has made as yet "but the veriest beginning," — but in the end the improvement of mankind and the development of the human soul are within the range of its potentials. The geological address, by Prof. N. H. Winchell, is in marked contrast to that of Professor Thurston. It is a paper of purely professional interest. He discusses, as a geologist, the crystalline rocks of the northwest, and especially of Minnesota. It has been usual to refer these rocks either to the Huronian or the Laurentian: now this nomenclature is acknowledged to be imperfect. The difficulties and incongruities of the situation are clearly set forth. Professor Cope likewise addresses an audience of specialists, — though the biological specialists in these days are a very comprehensive company. His subject is 'Catagenesis;' and he announces his definition of life to be "energy directed by consciousness, or by a mechanism which has originated under the direction of consciousness," — and he concludes that "all forms of energy have originated in the process of running down, or specialization from the primitive energy." Professor Wormley's address on the applications of the microscope in chemical and micrometric observations is only given in abstract. Professor Morse discusses man in the tertiaries, — not any particular man, we may assure our sceptical readers, but the-possibly-to-be-discovered man. "The progenitors of quaternary man, under different genera possibly, are to be sought for in the tertiaries." In the section devoted to economics, Gen. John Eaton very briefly considers scientific methods and scientific knowledge in common affairs.

EXPERIMENTS IN MEMORY.

When we read how one mediaeval saint stood erect in his cell for a week without sleep or food, merely chewing a plantain-leaf out of humility, so as not to be too perfect: how another remained all night up to his neck in a pond that was freezing over; and how others still performed for the glory of God feats no less tasking to their energies, we are inclined to think, that, with the gods of yore, the men, too, have departed, and that the earth is handed over to a race whose will has become as feeble as its faith. But we ought not to yield to these instigations by which the evil one tempts us to disparage our own generation. The gods have somewhat changed their shape, 'tis true, and the men their minds; but both are still alive and vigorous as ever for an eye that can look under superficial disguises. The human energy no longer freezes itself in fish-ponds, and starves itself in cells; but near the north pole, in central Africa, on alpine 'couloirs,' and especially in what are nowadays called 'psycho-physical laboratories,' it may be found as invincible as ever, and ready for every fresh demand. To most people a north-pole expedition would be an easy task, compared with those ineffably tedious measurements of simple mental processes of which Ernst Heinrich Weber set the fashion some forty years ago, and the necessity of extending which in every possible direction becomes more and more apparent to students of the mind. Think of making forty thousand estimates of which is the heavier of two weights, or seventy thousand answers as to whether your skin is touched at two points or at one, and then tabulating and mathematically discussing your results! Insight is to be gained at no less price than this. The new sort of study of the mind bears the same relation to the older psychology that the microscopic anatomy of the body does to the anatomy of its visible form, and the one will undoubtedly be as fruitful and as indispensable as the other.

Dr. Ebbinghaus makes an original addition to heroic psychological literature in the little work whose title we have given. For more than two years he has apparently spent a considerable time each day in committing to memory sets of meaningless syllables, and trying to trace numerically the laws according to which they were retained or forgotten. Most

Ueber das gedächtniss. Untersuchungen zur experimentellen psychologie. Von Herm. Ebbinghaus. Leipzig, *Duncker & Humblot*, 1885. 10+169 p. 8°.

results, we are sorry to say, add nothing gross experience of the matter. Here, ie case of the saints, heroism seems to wn reward. But the incidental results ally the most pregnant in this depart- and two of those which Dr. Ebbinghaus ched seem to us to amply justify his

The first is, that, in *forgetting* such as these lists of syllables, the loss goes much more rapidly at first than later e measured the loss by the number of s required to *relearn* the list after it had nce learned. Roughly speaking, if it thousand seconds to learn the list, and ndred to relearn it, the loss between learnings would have been one-half. ed in this way, full half of the forgetting o occur within the first half-hour, whilst ur-fifths is forgotten at the end of a

The nature of this result might have ticipated, but hardly its numerical pro- s.

other important result relates to the n whether ideas are recalled only by hat previously came immediately before r whether an idea can possibly recall idea, with which it was never in *iate* contact, without passing through ermediate mental links. The question heoretic importance with regard to the which the process of 'association of must be conceived; and Dr. Ebbing- attempt is as successful as it is original, ging two views, which seem at first accessible to proof, to a direct practical d giving the victory to one of them. periments conclusively show that an not only 'associated' directly with the t follows it, and with the rest *through* t that it is *directly* associated with *all* e near it, though in unequal degrees. measured the time needed to impress memory certain lists of syllables, and e time needed to impress lists of the llables with gaps between them. Thus, nting the syllables by numbers, if the was 1, 2, 3, 4 . . . 13, 14, 15, 16, the would be 1, 3, 5 . . . 15, 2, 4, 6 . . . 16, orth, with many variations.

if 1 and 3 in the first list were learned order merely by 1 calling up 2, and by up 3, leaving out the 2 ought to leave with no tie in the mind; and the list ought to take as much time in the as if the first list had never been . If, on the other hand, 1 has a *direct* on 3 as well as on 2, that influence e exerted even when 2 is dropped out; and a person familiar with the first list ought to learn the second one more rapidly than otherwise he could. This latter case is what actually occurs; and Dr. Ebbinghaus has found that syllables originally separated by as many as seven intermediaries, still reveal, by the increased rapidity with which they are learned in order, the strength of the tie that the original learning established between them, over the heads, so to speak, of all the rest. It may be that this particular series of experiments is the entering wedge of a new method of incalculable reach in such questions. The future alone can show. Meanwhile, when we add to Dr. Ebbinghaus's 'heroism' in the pursuit of true averages, his high critical acumen, his modest tone, and his polished style, it will be seen that we have a new-comer in psychology, from whom the best may be expected. W. J.

NOTES AND NEWS.

THE articles of scientific interest in the general English and American magazines for August are neither numerous nor interesting. Two topics seem to have monopolized the popular scientific mind during the midsummer months, — dogs and cholera.

There are two articles on dogs worth mentioning. One is a paper in *Bailey's monthly magazine* on 'The descent of the foxhound,' in which the writer attempts to show that the foxhound was produced about the beginning of the eighteenth century by a process of careful selection, and not, as some have supposed, by crossing a swift-footed hound with some dog of keener scent. In the *Century* appears the second part of Mr. John E. Thayer's beautifully illustrated account of 'Typical dogs.' A clear and concise account is given of the appearance, traits, etc., of the water spaniels, collies, and fox-terriers.

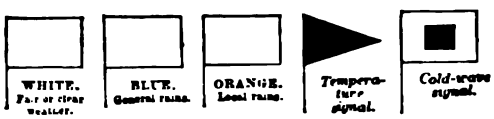
Six gentlemen of the medical profession have taken occasion to express themselves on the cholera question.

In the *Nineteenth century*, Dr. Charles Connor, in an article entitled 'Anti-cholera inoculation,' attempts to show statistically that Dr. Ferran's experiments have been more successful than those of Jenner were; and that by the anti-cholera vaccination process the danger of dying from cholera is made about six times less than it would be under normal circumstances. Dr. J. Burdon Sanderson, in the *Contemporary review*, gives his views on the causes and prevention of cholera. This writer gives a brief sketch of the history of cholera, shows to his own satisfaction that Koch's comma bacillus has nothing to do with cholera, and then goes on to say the ordinary things about good drainage, careful diet, etc. But it is in the *North-American review* that the greatest number of articles, and the least amount of information, is to be obtained on the subject of Asiatic

cholera. Four gentlemen, Dr. John B. Hamilton, Dr. H. Rausch, Dr. C. Peters, and Dr. H. C. Wood, have each tried to answer the question: Can cholera be averted? In these papers the germ origin of cholera is admitted, but no particular bacillus is fixed on as the cause of the disease. The best methods of disinfection, etc., are spoken of, isolation of the sick recommended, and the necessity of cleanliness is urged; but no facts or theories are set forward of which the public are not already in possession.

Besides the notes on dogs and cholera, there have also appeared one or two other articles which might be called semi-scientific. In the *Gentlemen's magazine*, there is an interesting and well written paper on the wild cattle of North America, by C. F. Gordon Cummings, describing the appearance, distribution, and extinction of the American bison; and the *Cornhill magazine* has a very popular article on the 'Birth of mountains.'

— The Alabama state signal-service found it impracticable to use the same signals employed by the Ohio service, for three reasons: 1°. Because the railroad refused to allow red to be used on their lines. 2°. On account of the considerable cost of the Ohio set of signals (eighteen to twenty-four dollars); and 3°. From the fact, that, in a calm, it was found impossible to distinguish between the star, the crescent, and the sun. After correspondence with the U. S. chief signal-officer, five flags were determined on according to the accompanying illustrations. Their



cost when made of bunting is something less than that of the Ohio flags: and when made of cotton cloth, the outlay is only a few cents each; while the solid colors allow the predictions to be read at a considerable distance. The railroad authorities have entered cordially into the system, and telegraph the predictions free of charge; except in the case of two or three companies not owning their telegraph lines, who expose the signals on their trains. In most cases they are hung on poles. The black triangular flag when placed above indicates rising temperature; when placed below indicates falling temperature; if absent, indicates stationary temperature.

— On account of the lack of funds necessary to maintain its activity, the astronomical observatory of Beloit college, Wisconsin (Prof. J. Tatlock, jun., director), has been closed.

— The annual meeting of the American forestry congress will be held at Boston, beginning Sept. 22, under the auspices of the local societies of horticulture and agriculture. Mr. W. C. Strong of the Horticultural society is chairman of the local committee, and Mr. Daniel Needham of Boston is the chairman of the sub-committee of accommodation; and to the latter, requests for special arrangements for board should be sent. The hotel headquarters will be at the Adams House. Three sessions daily will be held at Horticultural Hall. Monday, Sept. 22, will be given up to addresses, reports, and general business; Wednesday, to the reading of papers and discussions; and Thursday, to excursions, — among others, to the Arnold Arboretum. Over twenty papers have already been promised, and many others are expected. The discussions will be conducted as far as possible under the following heads: 1°. Importance of forests in climatic and hydraulic respects, and in regard to other industries. 2°. Duties and rights of the state to protect her forest resources. 3°. Forest fires: causes; laws and methods for their restriction. 5°. Education and research in forestry matters: arbor days; schools; lectures; exhibits; experiment stations; press; associations. 5°. Practical forestry: prospects, methods, profits, etc.

— If any indication of the mathematical activity of different nations is afforded by the number of those who have published contributions bearing upon one of the most notable of recently developed branches of mathematical investigation, England is at this moment occupying a very subordinate position in the advancement of pure mathematics. A bibliography of the modern theory of linear differential equations, which appeared in the last number of the *American journal of mathematics* (vol. vii., No. 4), gives in all sixty-eight writers, of whom only two are English, while twenty-seven are French, seventeen German, nine Italian, and the rest are divided among eight different nationalities, there being one American. This disproportion between the English and the French or Germans, is greatly increased, when the number and importance of the memoirs contributed by the various writers are taken into account.

— We learn from *L'astronomie* that the crown disk for the great thirty-six-inch refractor of the Lick observatory, referred to in an earlier column, has recently been delivered to Alvan Clark & Sons, by Feil, the celebrated Paris manufacturer of optical glass. The elder Feil has reorganized the establishment, associating with himself his son and M. Mantois. The two disks for the thirty-inch Nice refractor have been placed in the hands of the Henry brothers, who take charge of the optical work; and it is hoped that the glass will be finished in October.

— The American philological association will hold its next meeting at Cornell University, Ithaca, N.Y., on July 13, 1886. The presiding officer will be Professor Tracy Peck of Yale college.

— *Nature* states that it has been decided to withhold from publication the report of Drs. Klein and Gibbes upon Dr. Koch's discoveries in relation to the germ theory of cholera, until the conclusions of a committee appointed by the secretary of state for India with reference to that report are also ready.

— *Ausland*, a German weekly published at Stuttgart, is now printing an interesting serial upon the influence of the glacial period upon the formation of the physical surface of Lower Germany, by Th. Overbeck, in which Torell's hypothesis is subjected to criticism. This weekly is now in its fifty-eighth year.

SCIENCE.

RIDAY, SEPTEMBER 11, 1885.

AMERICAN ASSOCIATION AT ANN ARBOR.

vell known in what a dilemma the as- was placed at the close of the Phila- neeting. Without an authorized invi- om any community to hold this year's within its bounds, and propelled by re to find cooler quarters than those in Philadelphia, the council hesitated Mount Desert and Ann Arbor. It for a college professor to cut short his rest, and hurry back to make his s happy during their week's stay near ure-room; and it is especially to be d, that each year some well-worked ve up their whole vacation, or add to rking hours, that the expected visitors kindly cared for. If there is any re- r this unselfish labor, it comes in the tion with their reception shown by the s. And we are confident that all who en present at the Ann-Arbor meeting glad that the proprietors of the hotels nt Desert turned a deaf ear to the ls of the association secretary; and citizens of Ann Arbor, urged perhaps by Prof. J. W. Langley, tendered to ociation the use of their halls and and the promise of a kindly welcome. very side were heard expressions of at the arrangements of the local lee. The rooms of the university fur- he most convenient meeting-places the ion has used for many years. The was not a large one, the total attend- members reaching only 364; but the if not the number (176), of papers d was up to the average.

g the meeting, two changes were made organization. By one, the section of y and microscopy was abolished. This change has been urged for some time by those who do not think a special science of microscopy exists, but that the microscope is a tool used by scientific men in various branches. The other change was in the name of the section of mechanics, the words 'and engineering' being added to the title, that it may be more clearly understood by Americans that those interested in all branches of engineering are invited to take part in the proceedings.

As this was the first meeting of scientific men since the action of the government in regard to the coast-survey, it is not surprising that the question should have been discussed in private and by the council. The matter was referred to a committee, which offered a series of resolutions given on another page. At the Friday meeting, when the report of this committee was made to the society, the interest of those present was shown by the eager gathering into a more compact body, that the debate might be the more readily followed. The discussion proved to be purely formal, no one offering any objection to the resolutions, which were unanimously accepted as the sense of the meeting. Indorsing remarks were made by Prof. S. P. Langley, Dr. James Hall, Prof. T. C. Mendenhall, and others.

In every direction, one sees at the association meetings the conspicuous badge of the reporter; and each secretary, at the close of the session of his section, is approached by discomfited members of the press, for at least a few suggestions as to what the talk has all meant. Each day, one is urged by the newsboy to buy a 'full account' of the proceedings. He may find some information as to the programme, but will probably be disappointed in the report of the papers and discussions, even of those which could be made interesting to the laymen. There are always a few eccentric individuals present, and these furnish a fruitful theme for the reporters' wit; and the officers of the association come in for a share of attention.

But an account of the meeting which should convey to the public any idea of what it is all about is wanting.

We have again to call attention to the unsatisfactory nature of the reports of the special committees of the association. While in England much of the most valuable work of the corresponding association is the result of investigations carried on under the guidance of its committees, in our association the reports consist mostly of a mere statement that the majority of the members are alive and well, and would be glad to be continued as a committee of the association for another year. As a conspicuous exception, we would call attention to the report on stellar magnitudes, due to the exertions of Prof. E. C. Pickering, which is to be printed in full. The botanists also have brought about some good results.

Some of the statistics of the meeting may be of interest. The number of papers presented was naturally not so large as last year, but exceeded that at any recent meetings in the west; the largest number being presented in section F (32), followed at no great distance by sections B (23), E (27), and H (26). Section G, with its four papers, held but one day's session, and was then merged in F. Section D, with twelve papers, completed its work in two of the four days given to papers. Section A, however, with the same number, remained in session three days; and though the sessions of B closed also on the third day, C and I, with fewer papers (17 and 21 respectively), continued through the four days. One hundred and fifty-four new members were elected, sixty-eight members were advanced to fellowship, and three hundred and sixty-four members and fellows were in attendance.

Although the meeting was a small one, the necessity of despatching business with greater promptitude was so apparent, that additional changes in the constitution were proposed to effect this, besides those which could be decided at this meeting. In accordance with a formal proposition last year, it was decided to elect members by the standing committee instead of in general session; but the association thought it would also be wise to select the fellows i the same way, and the need of a daily gener session preceding the sectional meetings w thus less obvious. The general session undoubtedly advantageous as bringing t gether once a day all the members of t association, but very disadvantageous to work; since after a half hour so spent, t members divide into the various sections, oft at some distance from each other, and mu delay and confusion result. It is proposed restrict the general sessions to the beginni and close of the meeting, and to limit t public reading of committee reports in gene session to such as seem to the standing co mittee specially desirable from their interest importance. All these are excellent prop sitions, and will come up for decision ne year.

The next meeting will be held at Buffal N.Y., beginning Aug. 18, 1886, under t presidency of Prof. Edward S. Morse Salem, Mass.

THE COMMITTEE REPORTS.

The following is a general account of the repo of committees made to the association at its gene session, Monday morning, Aug. 31: —

The committee on the best methods of scien teaching in the public schools reported, through H John Eaton of Washington, that considerable pr ress had been made, and that everywhere vari associations and schools, as well as individuals, w working upon the subject, and many important periments had been made. The committee, howev was not prepared to make more than a verbal sta ment, and, on its request, was continued.

The committee on the registration of deaths, birt and marriages, reported, through Mr. E. B. Elli of Washington, that the object of this committee w to bring about the co-operation of the government the United States and the several states in establi ing a uniform and efficient system of registrati Bills have from time to time been presented by co mittees of congress, — the last congress having, in bo houses, considered bills identical in character, — bu for various reasons, delay had prevented actio There had been no adverse action: the bills h received the hearty co-operation of many earn friends in both houses, and favorable action in t near future might be expected. The information d sired to be secured would be useful to individuals securing the legitimate descent of heritable proper

which necessarily changes ownership on an average three times a century; useful to people at large in determining the relative salubrity of localities when compared with the census returns; and especially useful in preparing tables of annuities, and other tables bearing on the duration of human life. On the request of the committee, it was continued.

The committee on stellar magnitudes reported that the chairman of the committee, Prof. E. C. Pickering, was to have sent an elaborate report with tables, which had been considered in committee; but probably, by some miscarriage, it had failed to reach the general secretary. On recommendation of the standing committee, it was voted that the report should be printed, and the committee continued.

The committee to confer with committees of foreign associations for the advancement of science, with reference to an international convention of science associations, reported, through Dr. C. S. Minot, as follows:—

This committee reports that it has conducted an extensive correspondence, and made considerable progress. The question of an international convention in London is now before the British association, and dependent upon its action, which cannot be reached before its meeting in Aberdeen. The committee is not at liberty to publish the correspondence; but it feels that much progress has been made, and it seems not improbable that a meeting will be held in London within a few years. Owing to the liberality of Mrs. Elizabeth Thompson of Stamford, Conn., an endowment has been secured, and twenty-five thousand dollars placed in the hands of a board of trustees, the income to be expended in the promotion of pure science by the international convention when organized. For this, Mrs. Thompson deserves the thanks of our association. A fuller account of this will be found in *Science* for Aug. 28. In regard to the gift of Mrs. Thompson, this sum of twenty-five thousand dollars comes in five thousand dollars presented last year by Mrs. Thompson, and twenty thousand dollars presented by her this last spring. The two sums have been placed together: a board of trustees has been organized, with Dr. H. B. Bowditch of Boston as Chairman; and having for its other members, Mr. William Minot as treasurer, President F. A. Walker of the Massachusetts institute of technology, Prof. E. C. Pickering of the Harvard observatory, and Dr. C. S. Minot as secretary. Mrs. Thompson, seeing the international association might not immediately come into existence, and desiring to render her fund immediately available for the promotion of science, has very liberally empowered the trustees to expend the income in such manner as shall seem to them desirable, until it shall be transferred to the board for which it is ultimately designed. In consequence of this liberality of Mrs. Thompson, we shall have at our disposal a considerable sum, available this autumn, which will be appropriated in some manner for pure investigation or research of some kind yet to be determined; and the board of trustees will make a public announcement of the manner in which appropriations may be made from this endowment. I myself, continued Dr. Minot, regard this endowment, from the very liberal terms in which it was made, as one of exceptional value; and it seems to me that this association should, in the most cordial manner in its power, express to Mrs. Thompson its thanks for her liberality to science. I have further to report, on behalf of the standing committee, its recommendation that the report of this committee be accepted, and the committee continued, and the name of the committee changed from its present very long title to the 'Committee on international scientific congress.' The recommendation of the standing committee was adopted, and the standing committee was directed to prepare a suitable resolution of thanks to Mrs. Thompson.

The committee on the International congress of geologists reported that two members of the committee would attend the coming congress in Berlin, and a report should be expected at the next meeting of the association.

The committee in relation to duties on scientific books reported progress, and requested that the names of Professors Baird, Newcomb, and Mendenhall should be added to the committee, and this was done.

The committee on the uniformity of graphic illustrations in representing facts of statistics, etc., reported that the committee had been formed at the instance of Mr. Francis B. Hough, since deceased. The remaining members of the committee recommended its discontinuance, as no one of them was ready to undertake the charge of the work which Dr. Hough had planned: the committee was discharged.

The committee appointed at the last meeting of the association upon the encouragement of researches upon the health and diseases of plants, reported through Mr. J. C. Arthur, that, considering that its most important work was to secure the coöperation of the department of agriculture at Washington, it had urged upon the commissioner the establishment of a bureau or division in that department for the study of plant-diseases, especially those affecting fungi; and urged upon him, that, in the appointment of an officer to make such investigations, he should select a man whose training had been such as to enable him to call to his aid all the knowledge and appliances of the best modern scientific methods. In accordance with the recommendations of the committee, the commissioner reported his hearty sympathy with the objects of the committee, and announced that he had appointed Mr. F. L. Scribner of Girard college, Philadelphia, to take charge of such work for the department. On the recommendation of the standing committee, this committee was reconstituted with the following members: J. C. Arthur, C. E. Bessey, T. J. Burrill, W. G. Farlow, and Charles V. Riley.

Other committees reported progress, and were continued. Some of their reports were, by recommendation of the standing committee, read in the section to which the subject appertained. One or two committees were discharged.

THE RESOLUTIONS CONCERNING THE COAST-SURVEY.

The following are the resolutions referred to in our leading article, and unanimously passed by the association at its general session of Aug. 28:—

Whereas, The attention of this association has been called to articles in the public press, purporting to give — and presumably by authority — an official report of a commission appointed by the Treasury department to investigate the condition of the U. S. coast-survey office, in which report the value of a certain scientific work is designated as 'meagre;'

And whereas, This association desires to express a hope that the decision, as to the utility of such scientific work, may be referred to scientific men, —

Resolved, That the American association for the advancement of science is in earnest sympathy with the government in its every intent to secure the greatest possible efficiency of the public service.

Resolved, That the value of the scientific work performed in the various departments of the government can be best judged by scientific men.

Resolved, That this association desires to express its earnest approval of the extent and high character of the work performed by the U. S. coast-survey, — especially as illustrated by the gravity determinations now in progress, — and to express the hope that such valuable work may not be interrupted.

Resolved, That this association expresses, also, the hope that the government will not allow any technical rule to be established that shall necessarily confine its scientific work to its own employees.

Resolved, That in the opinion of the American association for the advancement of science, the head of the coast-survey should be appointed by the president, by and with the advice and consent of the senate, should have the highest possible standing among scientific men, and should command their entire confidence.

Resolved, That copies of these resolutions shall be prepared by the general secretary, and certified by the president of the association and by the permanent secretary, and shall be forwarded to the president of the United States, and the secretary of the treasury, and given to the press.

PROCEEDINGS OF THE SECTION OF ASTRONOMY AND MATHEMATICS.

Perhaps the small number of members in attendance, especially in section A, and the consequent dearth of papers, may have been, in the minds of the sectional committee, a sufficient excuse for the appearance of the first two numbers upon the programme; but it would certainly be far better to reduce the number of meetings of the section in such a case, and thus grant its members more opportunity for hearing valuable papers in others, than to occupy its time, and detract from its dignity, by the serious consideration of such material as that first offered to the section of mathematics and astronomy. The first of these choice contributions was by Mr. Thomas Bassnett of Jacksonville, Fla., entitled 'Intimate connection between gravitation and the solar parallax.' The only important truth stated in the paper, the one set forth as a new and important discovery, and the principal feature of the matter, was simply another way of stating Kepler's third law, and offers no method whatever of determining the solar parallax. The rest of the paper was principally nonsense. The next paper by Mr. S. S. Haight upon 'Rapidity of calculation,' etc., was only a *résumé* of some short cuts, principally in cross-multiplication, which are given in many elementary arithmetics, and are familiar, or would suggest themselves, to any one having occasion to make any extended computations in that manner; while the speaker's remarks about the use of logarithms only served to show his ignorance of the whole matter.

The section then settled down to the consideration of serious business in listening to a paper by Prof. H. A. Newton of Yale college, upon 'The effect of small bodies passing near a planet upon the planet's velocity.' The former researches of Professor Newton, upon meteors, are recognized among astronomers as our principal source of knowledge about the character, distribution, and motion of these minute bodies with which the solar system is filled, especially those which strike our atmosphere, and are burned up as meteors. The possible effect of these upon the rotation of the earth, and the revolution of the earth and moon in their orbits, has been subjected to elaborate investigation at the hands of several mathematical astronomers. The recent publications of Mr. Denning of Bristol, Eng., claiming the fixity of long-continuing radiant points of meteor streams, have raised the question of the existence of broad streams of meteoroids moving swiftly through stellar space outside of solar attraction; and any new investigation bearing upon any of these points is more than usually timely. In this paper Professor Newton has discussed the effect upon the earth's motion of those bodies which do not pass near enough to the earth to be drawn into its atmosphere, but still near enough to be drawn out of their course, and swung for a time in hyperbolic orbits round it. He began by saying that the results of the investigation might perhaps be considered negative as far as measurable quantities in the solar system are concerned, but that they had a mathematical interest, and might possibly have a bearing upon somewhat similar questions in molecular physics, like the kinetic theory of gases. The mathematician and astronomer must be referred to the paper itself, but the results of popular interest may be briefly summarized as follows: Considering, first, the case of a cylindrical stream of small bodies evenly distributed, and all moving in the same direction with a common velocity past the earth supposed to be in the axis of the cylinder, it is shown that they will communicate to the earth in each unit of time a velocity along the axis: 1°, that is proportional to the density of the group; 2°, that decreases as the

velocity increases, nearly inversely as the square of the velocity; 3°, that increases as the logarithm of the radius of the cylinder, the radius being measured by a unit differing from the earth's radius by a small quantity, which is a function of the velocity. Second, in the case of a widely extended group of small bodies evenly distributed in space, and having speeds all equal, but directed towards points evenly distributed over the celestial sphere with the earth moving in a right line through them, it is shown that, for those which do not strike the earth, but only affect it by their attraction, the effect will be an exceedingly minute acceleration of the earth's motion, if the latter *is less than that of the bodies*, even though the group is infinite in extent. If the earth's velocity *is greater than that of the bodies*, their total effect will consist of two parts; a very minute retardation of the earth's motion depending in amount upon the absolute velocity of the bodies, and another retardation depending upon the assumed extent of the group. In conclusion, the effect of bodies *striking* the earth or moon is manifold greater than that of those only *passing near;* and since it has before been shown that any admissible magnitude of meteoroids would make the effect upon the moon's mean motion of those which strike it only a minute fraction of the observed acceleration, still less can any action of those passing near the moon have any appreciable effect. The hour of adjournment prevented any discussion of this interesting paper.

The first paper of Friday's session was by Prof. Wm. Harkness of the U. S. naval observatory upon the flexure of transit instruments. The time-observations of the different transit-of-Venus parties in 1874 and 1882, — and the latitude observations as well, — were made with transit instruments of the 'bent' or 'broken' pattern; i.e., a totally reflecting prism is placed in the tube of the axis, and thus one-half of the axis itself forms a part of the telescope tube, the eye-piece and micrometer being at one end of the axis. This form, while allowing great convenience and rapidity of manipulation, introduces new difficulties through the flexure in the support of the central prism; and the discussion of these has led Professor Harkness to make a thorough investigation of the flexure of transit instruments from the most general standpoint. The details are of too technical a character for popular presentation; and we can only state the general nature of the subject, and give a brief summary of the points brought out. Astronomers, in the most exact measurements possible with their instruments, have always been obliged to consider even the most rigid of them as elastic, and as bending differently under the force of gravity as they are swung into different positions. But if they are entirely symmetrical in construction with reference to a vertical plane, it is generally assumed that the entire flexure takes place parallel to that plane; and hence that the line of collimation determined by reversal upon a collimator, or by a pair of opposite collimators, is at right angles to the axis when corrected for inequality and irregularity of pivots. But the special point of Professor Harkness's paper was, that, on account of unequal elasticity in the different parts of any instrument, this condition could only be certainly fulfilled when the direction of gravity through the instrument was not changed by the operation. This could only be done by reversal either upon a *zenith-collimator* or *over the nadir*, and in these two positions only could the line of collimation be considered as rigorously at right angles to the axis. The other conclusions were, that for the particular zenith distance at which a line of collimation is determined, that line possesses the essential properties of a line at right-angles to the axis, but for no other zenith distance; and that flexure at right angles to the meridian consists of two parts, the larger of which is measurable by a pair of collimators, but the smaller is only determinable by star-transits. For field instruments this method would be feasible; but in the case of larger meridian instruments, which are supposed to correct the positions of the stars, this would hardly be allowable in fundamental work. Prof. H. M. Paul of the naval observatory remarked that the results of the paper emphasized anew the necessity, in the great bulk of meridian observations, of work in zones, the positions of the zero-stars in these zones depending upon some good fundamental system like that of Auwers; and also, in the formation of such a system of fundamental positions, the advantage of giving greater weight to the work of different observatories upon the stars which culminated near their zeniths, provided they could determine their collimation by reversal upon a zenith collimator.

The next paper was by Prof. G. W. Hough, director of the Dearborn observatory at Chicago, describing some improvements recently introduced in the printing-chronograph, first designed and brought into use by himself at the Dudley observatory in 1871. This instrument is designed to print upon a fillet of paper the minutes, seconds, and hundredths of seconds, indicated by the clock which controls it, at any instant when an observing-key is closed by the observer's finger. The impression is made from the surface of three continuously running type-wheels, the swiftest of which revolves once per second, and is controlled each second by the standard clock. The recent improvements consist in engraved type on the face of the wheels in place of the rubber ones used at first, which required too frequent renewal; and of the substitution of a direct blow by an electro-magnet upon the type-wheel fillet, thus making the apparatus much more light and compact than the old form. For this Professor Hough uses three cells of a storage battery, each of about two volts electromotive force, and from 0.3 to 0.4 of an ohm resistance, thus furnishing a strong current for the printing-magnet. The cells are kept permanently coupled to the chronograph, and are charged by eight small gravity cells having a resistance of 7 to 10 ohms each. He claimed that it was perfectly reliable, and eminently a labor-saving machine; and described its use in making transit observations as a luxury that no one would do without after trying it, the mean of the seconds and hundredths being taken directly

on the fillet without transferrence to books. In response to inquiry, he stated that the difficulty in getting a circuit through a clock-pendulum and globule of mercury, which would be absolutely sure to close every second, might be entirely overcome by having the mercury pure and making sure of good connections; that the difference between commercial and pure mercury was a very marked one in this case. Mr. J. A. Brashear of Pittsburgh called attention to the growing importance of chronographic records in all employment of men and machinery, and described a very perfect system in use in some manufactories. Professor Newton referred to the very convenient system of the Repsolds, for printing rapidly the settings of micrometer-screws, as well illustrated upon the new Yale college heliometer in charge of Dr. Elkin. Prof. C. S. Peirce of the coast survey called attention to the great gain this would be in recording the readings of micrometer screws in the comparison of standards of length where rapidity was highly desirable, and especially the avoidance of the necessity of removing the eye continually from the eye-piece to read off the head. Professor Paul alluded to his hope of soon applying Repsold's apparatus where rapidity was of the first importance; viz., in recording the settings of the position-circle of the Nicol-prism in Professor Pickering's method of observing the eclipses of Jupiter's satellites, where as many settings as possible are wanted while the satellite is entering or leaving the shadow; and he said he hoped, with a chronograph-key in one hand, and managing the Nicol and its printer with the other, to be able to secure the record of the times and settings of the Nicol-circle every two or three seconds, working entirely in the dark, and keeping it up as long as desired.

The next paper, by Prof. J. Burkitt Webb, described a method of using polar coördinates, by transferring the origin from the centre to the end of the unit-radius, — thus substituting $(r-1)$ for r, — and then using the length of the arc and the distance out from its end upon the radius vector, as x and y are used in rectangular coördinates. He found this a very convenient transformation in the application of polar coördinates to the discussion of Amsler's planimeter; and pointing out that by substituting infinity for unit-radius in the equations thus transformed, they were reduced to those of rectangular coördinates, he thought this transformation of polar coördinates might be found generally useful.

The only paper on Monday was a presentation by Mr. C. H. Rockwell of Tarrytown, N.Y., of some results of his observations for time and latitude with the almucantar, an instrument devised by Mr. Chandler of the Harvard-college observatory a year or two ago, which promises at least to furnish an entirely new and radically different method of attacking the question of absolute positions of the stars, and very probably far to surpass all others in accuracy, on account of its freedom from systematic errors. The results thus far published by Mr. Chandler seem fully to confirm all that was expected of the instrument; and it is probably not too much to say, that it is the most important addition of the present century to the instruments and methods used in the determination of absolute star-positions. The sources of systematic error would seem to be almost wholly reduced to those of varying personal equation in the observation of transits at all speeds, and at all inclinations and directions over horizontal wires, and to possible systematic difference in atmospheric refraction in different azimuths. Mr. Rockwell exhibited some results, simply copied from his observing-books, illustrating the methods of reduction for time and latitude observations, and showing the degree of accuracy that can be attained by the instrument in both these directions. They served to show that the instrument when duplicated will give equally good results with the one first constructed; and their consideration gave rise to a very interesting discussion, participated in by many members, as to the character of work the instrument might be expected to do, in the course of which Mr. Rockwell answered, in a very entertaining way, many questions, put by various members, as to the details of observing and reducing, which were not before clearly understood on account of the novelty of the work. One of the most important problems which the instrument is specially adapted to investigate, and one which we hope Mr. Chandler will soon find time to undertake, is the determination of the declination of fundamental stars south of the equator, tying them to northern stars at corresponding zenith distances below the pole. This would seem to be by far the best, perhaps the only, method of connecting these together in a way that shall be free from systematic error.

PROCEEDINGS OF THE SECTION OF PHYSICS.

THE first paper read before the section of physics was by Prof. S. P. Langley, on the spectra of some sources of invisible radiations, and on the recognition of hitherto unmeasured wave-lengths. The measurement of infra red wave-lengths has heretofore been confined to those found within the range of the solar-heat spectrum. It is of interest to know whether there are other wave-lengths than those found in the sun's heat, so that we may perhaps explain how it is that the surface heat of one planet is maintained in spite of the ready radiations of extreme solar heat through the atmosphere. Our knowledge of wave-lengths is comparatively recent, as Fraunhofer gave the first accurate measures in 1823. His range of values was from .00036 to .00075 of a millimetre. The use of the florescent eye-piece and photography has extended the range. The extreme range of the normal eye is from about .00036 to .00081 of a millimetre, or a little over one octave. It has been known since the time of the first Herschel, that heat radiations existed below the range of vision; but it was supposed that glass absorbed this dark heat. In 1881 Professor Langley found that common glass was diathermanous to all the dark rays which come to us

from the sun, and he has determined the wave-lengths of a newly discovered solar region by direct observation. We have in this infra red portion of the sun spectrum the greater part of the heat which sustains organic matter on this planet; and the questions arise, Does the planet radiate heat of the wave-lengths that it receives from the sun; and How is its temperature maintained, probably several hundred degrees above the temperature of space, when our observations show that the direct radiations of heat from the sun can only raise it about fifty degrees above the surrounding temperature? Experiments at Alleghany show that the dark solar heat is transmitted by our atmosphere with less difficulty than the light; and if the radiations of the soil are of this wave-length, our planet should actually be cooler on account of its atmosphere than if it had none. With this in view, Professor Langley has carried on during the last two years measurements of the radiations from bodies of the temperature of our earth. Almost the only material which can be used for the prism and lenses in this work is rock-salt. It is needless to say that the polish deteriorates after a few hours' use, necessitating a constant resetting of the surface. Leslie cubes covered with lampblack, and filled with boiling water or aniline, were used as radiating surfaces. Nearly the whole heat spectrum from these sources passed through the prism at angles which the theories of our text-books have heretofore pronounced impossible. Speaking with reserve, Professor Langley says that we have every reason to believe that heat radiated by the soil has a wave-length twenty times that of the lowest visible line of the solar spectrum. Professor Langley's results are of interest to the physicist, as showing that the wave-lengths of something more than one two-thousandth of an inch are rendered highly probable; to the astronomer, because we find that the heat radiated from the soil is of a totally different quality from that received from the sun; so that the important processes by which the high surface temperature of the planet are maintained, can now be investigated with, we may hope, fruitful results.

Much of the success of Professor Langley's work depended on the possibility of making satisfactory lenses and prisms from rock-salt. Professor Langley's paper was followed by one by Mr. J. A. Brashear, on a practical of method working rock-salt surfaces for optical purposes. Mr. George Clark succeeded in making and polishing a rock-salt prism for Professor Langley, but otherwise none had met with success; and Professor Langley was assured by the best opticians, that a rock-salt prism could not be made to show the Fraunhofer lines. Mr. Brashear proved this prediction to be false. Mr. Brashear's method consisted in the use of a pitch bed, which, while yet soft, was flattened by a plate of glass; the pitch was then cooled by water, and upon it were drilled conical holes one-quarter inch in diameter, and half an inch apart; the surface of pitch was then warmed suitably, and upon it was pressed a true plain surface. Upon the polisher thus prepared was put a very small quantity of rouge and water. The polishing was done by diametrical strokes, the operator walking about the polisher as he rubbed; this motion must be constant and continued till the last traces of moisture disappear, and the prism is to be slipped off the polisher in a perfectly horizontal direction.

Prof. H. S. Carhart presented a paper on surface transmission of electrical discharges, which was an ingenious revision of work by Professor Henry. Prof. E. L. Nichols presented some further notes on the chemical behavior of magnetic iron, a continuation of work described in a paper at the Philadelphia meeting. In the absence of Professor William Ferrel, his paper on psychometry was read by title only. Major H. E. Alvord of Mountainville, New York, presented the results of telemetric observations at Houghton Farm. This is a method by which changes in temperature are transmitted and recorded electrically; and Major Alvord's results show that, with increasing experience, the records followed more and more satisfactorily the observations made on the mercurial thermometer.

Commander Theodore F. Jewell's paper on the apparent resistance of a body of air to a change of shape, described some experiments at the U. S. torpedo station, in which a disk of gun-cotton was exploded on a metal plate. Upon each disk of the explosive had been stamped the letters 'U. S. N.', and the year in which the material had been manufactured. After explosion upon the iron, similar indentations were found upon the plate as if the air in the indented letters had been driven into the plate.

Professor T. C. Mendenhall called attention to the modifications and improvements already made or desired in electrometers, especially with reference to their use in observations on atmospheric electricity. Observations of this kind have been made regularly for the last year or two; but, as Professor Mendenhall well said, the meaning of the variations recorded is still a mystery. Prof. A. E. Dolbear read three papers: in one he described a method of studying the contact-theory of electricity by means of the telephone. He has found that a click is produced in the telephone every time the circuit is broken between two heterogeneous materials, as copper and zinc. In another paper he referred to his success in employing a Bernstein incandescent lamp for projection purposes; and in the third he described a new galvanic element of high electro-motive force and great constancy, consisting of carbon in a saturated solution of bichromate of potash and sulphuric acid, and zinc in a saturated solution of ammonic chloride; nitric acid could be used in place of sulphuric. Mr. A. J. Rogers presented a paper on electrolysis of the salts of the alkaline earth.

It is much to be regretted that Prof. J. Burkitt Webb was obliged, by want of time, to refer so unsatisfactorily to his papers on entropy and the life of the universe, in each of which he presumably discussed matters in the interest of thermodynamics.

Prof. E. L. Nichols has, by means of a spectro-photometer described at a previous meeting, compared the spectrum of the unclouded sky with that of the light

reflected by magnesium carbonate, illuminated by direct sunlight. Repeated measurements of the relative intensities of corresponding portions of these spectra throughout their whole length, and similar comparisons of the spectrum of the magnesium carbonate with the direct spectrum of the source of illumination, have furnished data from which the character of the light sent us from the open sky can be determined, and, in one sense, its color also. The measurements show that the spectrum of the sky is of the same character as that of white light, varying less from the reflection spectrum of a perfectly colorless object than do the spectra of such substances as white paper, sulphate of calcium, carbonate of magnesium, lamp-black, etc. Similar measurements were made of the reflection spectra of Lord Rayleigh's 'blue cloud,' formed by the precipitation of sulphur by hydrochloric acid in a solution of hyposulphite of sodium, and of thin films of antimony oxide. It was found that the same is true of the light reflected by these substances. The blue color of the sky and of other opalescent media is, according to these results, not due to an excess of the more refrangible rays in the light reflected by them, but is of subjective character. This view the author has maintained in a previous paper, in which it was pointed out that a well-known peculiarity of the eye, its rapidly increasing sensitiveness to violet, with decrease of intensity of illumination, is sufficient to account for the appearance of the sky, and of many other objects, without having recourse to the hypothesis of selective reflection. The object of the present paper is the presentation of experimental evidence bearing upon this question. It is to be regretted that Prof. S. P. Langley had left town before this paper was read. A number of those present called attention to the disagreement of the results of Professor Nichols with those obtained by Professor Langley.

Professor Nichols's paper was appropriately followed by that of Prof. C. K. Wead, who exhibited a combined spectro-photometer and ophthalmospectroscope. This instrument, made by the Geneva society, is intended to combine with the least possible duplication of parts, several of the best instruments for the study of spectra. It gives the measure of the relative brightness of the spectra: 1°, by the width of slits or by smoked glasses; 2°, by Nicol prisms outside the collimator; 3°, by combination of the two. Further, it allows: 1°, the mixture of any two spectral colors in any relative intensity, and their comparison with an intermediate spectral color by 'Donder's coupled slits;' 2°, the addition of either the simple or the mixed color of a measured quantity of white light (Glan); 3°, the comparison of the simple or mixed colors of the spectrum with the light from a colored body.

In a paper on weather changes of long period, Mr. H. Helm Clayton of Ann Arbor cited evidence that there are at times slow progressive movements of barometric change, and of temperature from west to east. Mr. Clayton also made an attempt to show a certain periodicity in the character of the weather of the United States during the last year, and claimed to be able to make predictions based on this perio for a month in advance. The paper excited c erable adverse criticism.

Two papers by Dr. J. W. Moore of Easton, P were devoted to an explanation of apparatus for room demonstration of electrodynamic phenom A paper read by Prof. H. W. Eaton of Louis on the relation of vanishing and permanent netism, contained results of an investigation he had undertaken at the suggestion of Wieden

Prof. C. J. Reed of Burlington, Io., exhibi piece of apparatus for classroom demonstration laws of falling bodies.

CHEMISTRY IN THE SERVICE PUBLIC HEALTH.[1]

In the study of hygiene from the chemical sid are obliged to consider not only the normal c tions of the earth and atmosphere, but the cha which are brought about by the crowding togeth individuals on account of the pursuit of manufac ing industries.

In the service of sanitary science, chemistry ha educational office to fill. The public has very li conception of what the capabilities and limitati of chemistry are. It is hard to make a person lieve that water to be analyzed must be brought a clean vessel, and that the chemist cannot dist guish between the impurities of the water and th of the jug. It is almost impossible for the che cally uneducated public to understand that wh chemical action takes place, the properties of substances concerned are not carried into the pr uct; that because vitriol is used in glucose factor the product does not contain the acid; and the of aquafortis in making oleomargarine, is equa startling.

There must needs be reformers and philanth pists, but many of these are extremists; and nowh more than in sanitary matters, is a little knowled dangerous thing. At one time all the evils were tributable to microbes, and at another to sewer- Microbes may be left to the biologists, and possi sewer-gas as well, since chemists have failed to cover any substances in the gas which could prod the well-known ill effects. In the matter of adulteration, the origin of the terror is often ri ous; thus, that tea is said to be adulterated prussic acid, arose from the use of Prussian blu the facing. Chemists are periodically obliged to tinguish between adulterations which are me falsifications and those which are harmful, an must be remembered that even the purest comm cial products contain small amounts of foreign stances.

It is, perhaps, not altogether to our credit tha so often need the spur of extravagance to lead u

[1] Abstract of an address delivered before the section of c istry of the American association for the advancement of sci at Ann Arbor, Aug. 26, by Prof. W. R. NICHOLS, of the Mass setts institute of technology, Boston, vice-president of the sec

e the public the truth with regard to exist-
. An unvarnished statement of things as
lly are, cannot awaken that interest which
hen people imagine, after each meal, that
the effects of the alum in the bread, or
ing of the vitriol in the glucose adulterated
the heavy weight of the clay out of which
e-berries were moulded. It is certainly an
t service to public health, that of investigat-
actual state of existing evils; and noble ex-
f such service are seen in the investigations
Lancet of food sold in London. Another
ere chemistry comes advantageously in con-
the public health, is in the suggestion of
remedies for existing evils: some seem to
hat the proper method is, in all cases, to as-
the existence of the offence, and then to
discontinuance; but generally, where the
been long growing, and where our pecuniary
are involved, such summary legislation is,
, unjust.

ier, Berthollet, and, in more recent times,
nd and others, have interested themselves in
lication of chemistry to sanitary purposes;
enkoffer and Angus Smith have been spe-
ominent workers in this line. This list shows
chemists have been willing to devote their
sanitary chemistry; but how often it is the
t a brief course in analysis is held to justify a
n acting as an adviser, as the state assayer or
nalyst!

sor Nichols stated that he had been asked,
sanitary chemistry? Is it any thing more
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had but to follow a mechanical process.
wledge of the normal composition of the at-
e rests upon the analysis of many chemists;
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alth of the variations to which the atmos-
subject? How much, in spite of the work
ssor Remsen, do you know of the organic
the air, and the proper methods for its de-
and estimation? Professor Remsen and
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lon and amount of the gaseous 'somethings'
ake the anthracite-heated atmosphere of our
different from that of a house heated by a
nace? It is asserted by some that the day of
examinations is passing away, and that the
neness of water will be determined by the
not by the chemist. Without detracting
present value of biological methods, we
lieve that they can replace chemical exam-
r a long time yet: it must first become cer-
all the evil effects of impure water are due
anisms now so eagerly studied. When the
examination of water has been placed on a
, it will then be necessary to carry out the
un by Professor Mallet, of discovering the
characteristics which belong to waters
biological examination condemns, and of
making these characteristics the basis of future chemical analysis. In the matter of the pollution of streams by sewage, there is much chemical work to be done. The natural purification of streams is admitted to be a fact; but chemists differ as to the extent to which it takes place, and the agencies at work. The action of oxygen has been and is to-day being studied; but clear light will not be obtained so long as we are content to speak of 'organic matter' as though it were a definite something.

Sanitary science comes nearest to the public in the examination of foods and drinks. Chemical examination of such substances has long been provided for by law, and in recent years has seen greatly increased activity. Provision is made on the continent of Europe for such examinations; and there are laboratories at the service of the public, either gratis, or under a tariff often ridiculously low. In this country, more or less stringent laws against adulteration exist; and these laws, in some states, have been made more stringent on account of popular feeling, which was at its height in 1878 and 1879; but the enforcement of such laws is usually in the hands of the state boards of health, which are often hampered by the want of suitable appropriations. As far as Professor Nichols was informed, no laboratories have been established by states or municipalities, where the public can have analyses made either gratis, or for a moderate fee; and it is doubtful how far the establishment of such laboratories is desirable. The laboratories which exist in connection with various educational institutions are probably all that is needed; and there are advantages in securing the co-operation of a number of able chemists, as is done in New York State, and in assigning to each certain descriptions of articles for analysis.

Investigations in sanitary chemistry have been undertaken in the various agricultural and physiological laboratories; but one of the first — if not the first laboratory founded for the investigation of these questions — was that established in Dresden, in January, 1871, under the direction of Dr. Fleck. Among subjects investigated at this institution, were the various methods of water and food analysis, methods of protecting combustible and inflammable material, and the effect of arsenical papers upon the air of rooms. The state board of health of Massachusetts led the way on this side of the water, and the earlier reports of the board contain many papers on similar questions.

The education of those who propose to follow this line of work requires a thorough knowledge of general and analytical chemistry, and of physics. It is quite possible to take a bright lad from the grammar school, or even from the street, and teach him to make analytical determinations with great accuracy; but this does not make a chemist of him. Courses in sanitary engineering in our technical schools have been established, but how far these courses will develop does not yet appear. In order that the student may have an intelligent idea of what questions should be submitted to the chemist, and how the results obtained should be understood, he should

have a good knowledge of the principles of chemistry. Sanitary inspectors should be familiar with certain chemical tests which would enable them to make preliminary examinations, and to determine how far the aid of the chemist is necessary. There is room in the community for a class of persons knowing a little engineering, a little chemistry, a little biology, and a little of other things, an occupation legitimate and honorable, but one which does not justify our calling a person so posted a sanitary engineer, or a chemist.

PROCEEDINGS OF THE SECTION OF CHEMISTRY.

The meeting of the chemical section had an unusually large attendance; and Ann Arbor, not having very many attractions to withdraw the attention of members, allowed all chemists in attendance to be present. The total number of papers presented was small, — in all only seventeen. Of these one was not chemical, one was every thing, one organic, one applied, two mathematical, two pharmaceutical, three theoretical, and six analytical. The meeting, while not brilliant, was respectable, and was remarkable chiefly for the absence of the older and more renowned chemists of the country. It would certainly be an advantage if these would more generally endeavor to attend the meetings of the association, and encourage the younger members by their counsel. Following is a brief synopsis of the more important papers presented: —

Prof. A. B. Prescott gave results of experiments made under his direction, fixing the limits of recovery of certain poisons when mixed with organic matter, such as meat and bread.

Prof. W. A. Noyes read a paper on para-nitrobenzoic sulphunide. This body belongs to the class of sulphunides, the first representative of which was discovered by Fahlberg. The new substance is remarkable, in that it retains the imide grouping peculiar to the sulphunides in its salts. This nitrosulphunide is intensely bitter, while benzoic sulphunide is probably the sweetest substance known.

Dr. H. W. Wiley presented a method of estimating lactic and acetic acids in sour milk or koumiss. The caseine is precipitated by adding an equal volume of strong alcohol to the milk. After filtering, the acid is determined in the filtrate, using phenyl-phthalein as indicator. The same author spoke of the composition of koumiss made from cow's milk. The analyses show a lower percentage of alcohol and lactic acid, and a higher one of milk-sugar and fat, than are found in European samples, whether made from cow or mare's milk. The adulteration of honey was also discussed by Dr. Wiley. The honeys of commerce are found to be largely adulterated. The substances most used for this purpose are, starch-sugar sir (glucose), cane-sugar, and inverted cane-sugar. R sults of numerous analyses made at the departme of agriculture were given, and a comparison of Am ican honeys made with those of Europe.

Messrs. H. W. Wiley and F. V. Broadbent descri a new method of estimating water in glucose, hone etc. Samples are dissolved in alcohol mixed with weighed portion of sand, and dried. After cooli to 70° C, they are saturated with absolute alcohol, a dried again to constant weight.

Messrs. E. H. Cowles, A. H. Cowles, and C. Mabery, presented an important and interesting pap on a new electric furnace, and aluminum alloys ma in it. The furnace is of fire-clay. The mass to acted on is mixed intimately with finely-powde gas-carbon, and is placed in the break between t two electrodes, which are inserted in the two end the furnace, and connected with a powerful dynam electric machine. The mass to be reduced is s rounded with coarsely pulverized charcoal, to prev the heat produced from attacking the fire-clay f nace. The temperature of the furnace is high enou to produce an alloy of copper and aluminum, wh the aluminum is present in the state of oxide, or ev of silicate. The aluminum alloys produced by t method cost much less than when made in the way. The five per cent aluminum alloy is a close proximation in color to 18 carat gold, and does readily tarnish. Its tensile strength, in the form castings, is equivalent to a strain of 68,000 lbs. to square inch. An alloy containing two or three per c aluminum is stronger than brass, possesses gr permanency of color, and would make an excell substitute for that metal. The effect of silicon the small portions, upon copper, is to greatly incre its tensile strength; and copper and silicon alloys made easily in the furnace. When more than five cent of silicon is present, the product is extrem brittle. Alloys of copper and boron have also b made. Boron seems to act upon copper as car does on iron. A small percentage of boron in cop increases its tensile strength to 50,000 or 60,000 per square inch, without diminishing to any gr extent its conductivity. Aluminum seems to incre very considerably the strength of metals with wh it is alloyed. An alloy of copper, nickel, and z containing a small percentage of aluminum, has b named 'Hercules metal,' and withstood a strain 105,000 lbs. to the square inch. The strength of c mon brass is doubled by the addition of two to th per cent of aluminum. Alloys of aluminum and are obtained, without difficulty, in the furnace. product was analyzed containing forty per cen aluminum.

A chemical study of Yucca angustifolia was sented by Miss Helen C. D. Abbott. Besides m of the usual constituents found in plants, the foll ing were detected: manganese in the ash, four f oils, a new resin which it is proposed to name yuc another new resin which it is proposed to n pyrophacal, a red crystalline coloring matter, a gum, four crystalline compounds, and saponin.

the subterranean part of the yucca the oil extracted from the bark is solid at ordinary temperatures; from the wood it is of a less solid consistency, while the yellow base of the leaf contains an oil quite soft; and in the green leaf the oil is still more fluid. Yuccal was obtained from the bark and wood of the root. It is a transparent ruby-colored substance, melts at 70° C, and its specific gravity is 1.091. A blood-red color reaction was obtained by warming the resin with ammonium molybdate, and a few drops of strong nitric acid. Pyrophacal was extracted from the yellow base of the leaf, and melts at 79° C. The amount of saponin obtained in the wood varied from 8.95 per cent to 10.4 per cent. Saponin was also found in the bark and leaves of the plant.

Prof. F. P. Dunnington described a method of fixing crayon drawings. The drawings made on unsized manila paper are saturated with a preparation consisting of one part Damar varnish, and twenty-five parts turpentine. After drying, they are ready for use. A paper by the same author describes a peculiar porous mineral containing titanic acid, found on a steep mountain side, and evidently of igneous origin. The surrounding soil was found also to contain titanic acid. The origin of the mass is somewhat uncertain.

Mr. O. C. Johnson presented a paper on negative bonds, and a rule for balancing equations. After giving rules for determining bonds, the author presented his views of simple oxidation, oxidation with combination, double oxidation and complex oxidation in their relations to chemical equations.

Mr. A. V. E. Young presented a study of the thermo-chemical reaction between potassic hydrate and common alum. After describing the experiments which had been made, the following conclusions were reached: 1°. That if potassic hydrate in excess be added to alum, there results a characteristic distribution of constituents between the soluble and insoluble portions of the mixture. 2°. This distribution is a function of temperature, as well as of dilution and mass. 3°. This phenomenon is probably due to dissociation by water of compounds Al_2O_3, and SO_3, and of potassic aluminate.

Prof. J. W. Langley read a paper on the results of an investigation of the concentration produced by the differential action of chemism on certain acid radicles. The paper showed, that, by this action (as for instance when a copper plate is suspended in solution of argentic nitrate), the NO_3 divided into two parts, having an approximate ratio of 1:3. Copper and zinc in aqueous bromine behave in the same way. Copper in solution of ferric chloride, and zinc in solution of copper sulphate, produce a concentration of the radicle in opposition to gravitation.

By communication with the various members of the section, the secretary had arranged the following question for discussion: What is the best initiatory work for students entering upon laboratory practice?

Dr. H. W. Wiley was requested to open the discussion. He said it was with laboratory work largely as Pope said about governments, 'What's best administered is best.' Students beginning laboratory work should understand at once that chemical science is no guess-work, but a science of definite proportions. They should learn the use of the balance, and their experimental work in general chemistry should be conducted quantitatively from the start. Students should be taught to rely upon themselves: their faculties of observation and powers of reason should be developed. At first they should be kept as much as possible from books, and from too garrulous professors. They should be told nothing of the physical and chemical properties of a body, which, by proper diligence, and under wise direction, they might find out for themselves. For instance, in studying hydrogen, the student should be directed to take definite quantities of zinc and sulphuric acid, to measure the volume of gas given off, to dry and weigh the residual zinc sulphate, and study its properties, etc. Whether beginning students should be kept at work in the study of general chemistry, or be taught also analytical work, will depend largely upon the judgment and taste of the instructor. Laboratory work, in order to give its full benefit, must be combined with lectures and recitations: and through it all, the work illustrating stoichiometry must be fully done and comprehended. The progress of the work should be gauged neither for the dullest nor brightest pupil, but the middle course will be found best. In all cases, much will depend on the judicious oversight and guidance of the instructor.

Prof. R. B. Warder asked whether it were better to begin with gases or with metals? He was inclined to prefer metals, since their properties were more easily discovered. Prof. F. P. Dunnington suggested a course of metallurgy and assaying as being well adapted to a student's initial laboratory work; afterwards the use of the blow-pipe could be introduced. Mr. Thos. Antisell said that the object of instruction ought to be considered in determining its character. If the study of chemistry was begun only as a part of a liberal education, the course of instruction should be largely qualitative analytical work. On the other hand, if the pupil was looking forward to chemistry as a profession, it would be better to put him to quantitative work.

Prof. A. B. Prescott was impressed with the idea that the study of chemistry might be approached in two ways; viz., as descriptive chemistry, and, experimentally, in general chemistry. Students should, in analytical work, practice first on known bodies before beginning on unknowns. Care must be taken not to place too much reliance on laboratory work alone. It is of the utmost importance that rigid class-work in the lecture and recitation rooms go along with the experimental work in the laboratory. As great a mistake may be made by relying on laboratory work alone as there was formerly by neglecting it altogether.

Prof. C. F. Mabery regretted that chemistry was not taught practically in high schools and academies. School trustees generally thought that seventy-five dollars a year was a liberal allowance for laboratory purposes. He would have young people begin with common phenomena, such as the rusting of iron, etc.

He would insist on his pupils mastering the principles of stoichiometry, and in working, as far as possible, quantitatively, even in general chemistry. Mr. C. L. Mees heartily indorsed the ideas advanced by Professor Mabery. For three hundred dollars, a good practical chemical laboratory could be established in high schools, which, if properly conducted, would result in great good. He would insist on a student repeating his work until it was exact. No careless work should be allowed. Mr. C. W. Kolbe gave an illustration of high-school instruction in chemistry, which was evidently purely bookish. The young man who had passed a brilliant examination in stoichiometry failed to do the simplest kind of a problem afterwards, because, he said, 'it was not in the book.' Miss L. J. Martin thought chemistry should be taught in high schools so as to make the pupils think, and not become mere machines. Prof. O. C. Johnson gave an amusing account of the failure to develop the sense perceptions, which he thought should be an important part of laboratory instruction. Messrs. Bennett, Sheppard, Smith, and the acting vice-president, Lupton, also took part in the discussion.

The second subject discussed was, 'To what extent is the knowledge of molecular physics necessary for one who would teach theoretical chemistry?

Prof. J. W. Langley was invited to open the discussion on this topic. He gave a very clear and satisfactory exposition of the dependence of chemistry upon physics, and of their close relation to one another. He drew attention to the fact, that only under fixed or limited ranges of physical conditions do the ordinarily accepted reactions and chemical affinities manifest themselves. Professors Prescott and Lupton took part in the discussion, showing the advisability of delaying any attempts to teach the higher branches of physics until the student had advanced well in practical laboratory work.

THE SECOND LAW OF THERMODYNAMICS.[1]

The second law of thermodynamics has been chosen for the subject of this address: what that law is will be the main question, and the ground will be taken that Rankine's view of the subject is the correct one. After calling attention to the statements of Tait and others as to this law, and as to Rankine's way of stating it, no apology will be necessary for the choice of a question which ought already to have been fully and satisfactorily settled.

There are three different statements, each claiming to be the second law of thermodynamics. I. Rankine's law: "If the total actual heat of a homogeneous and uniformly hot substance be conceived to be divided into any number of equal parts, the effects of those parts in causing work to be performed are equal." Rankine gives also a second form of the law, in which the expression 'absolute temperate' takes the place of 'total actual heat.' II. Clausius gives as the 'Second fundamental principle,' "Heat cannot of itself flow from a colder to a warmer body." This may be a law in the general theory of heat, but not in thermodynamics, which treats of the relations between heat and mechanical energy; and it has nothing to do with Rankine's law, except as all natural phenomena may be connected. III. The formula for the maximum efficiency of a heat-engine is given as the second law, but this is only a consequence of that law, and the form of the engine.

It would seem from this variety of statement, that a law of nature might be any thing to suit our purpose. I think, however, that a careful examination of Rankine's second law will show that it is genuine, and that it is not universally quoted only because it is not understood. Rankine's law is either copied *verbatim*, or modified in a way to make this evident; and I must confess, that, before working upon the subject myself, I had difficulty with Rankine's statements: they seem now, however, so reasonable, that I shall endeavor to lead you to the same opinion.

Let us see now what is most natural and appropriate for a second law: the first law states that heat and work are mutually convertible, and convertible in a fixed ratio; and it is appropriate that the second law should state the agency by which such conversion may be accomplished, and the rate at which it may be effected.

A quantity of heat, W, may be employed as an instrument for the conversion of another quantity of heat, W, into work, or for the conversion of a quantity of work, A, into heat; and the converted quantity will be proportional to the converter quantity for a given change of volume or of entropy.

To realize the truth of this statement, let us imagine the simplest physical air-engine: we need no fly-wheel, valves, etc., but simply a vertical cylinder of infinite height, and unit section, with non-conducting walls, the bottom permeable to heat, and the non-conducting piston loaded with a pressure varying so as to be always equal to the gaseous pressure beneath it.

But this is no more than the shell of the engine: we will suppose the piston at such a point that the cylinder shall have a volume of one cubic unit; and we must now put in it, say, one unit of mass of the molecules of a perfect gas, resting on the bottom as dust, or distributed through the space as in any gas, but devoid of motion: we have now added the muscles, but they are dead flesh; the engine is not capable of transforming heat into work, or *vice versa*. The agent by which such a transformation may be accomplished is not present; the space through which the piston may move exists, but the molecules exert no pressure against the piston, and there can be no question of work until we have both space and pressure. To obtain this necessary pressure we must heat the gas to the absolute temperature, τ; i.e., we must store in the molecules an amount of kinetic energy proper-

[1] Abstract of an address delivered before the section of mechanical science of the American association for the advancement of science, at Ann Arbor, Aug. 26, by Prof. J. Burkitt Webb of Ithaca, N.Y., vice-president of the section. For the complete address, see *Van Nostrand's eng. mag.*, October, 1885.

tional to τ; and calculation shows us that the pressure, which they will then produce by rebounding from the piston, will be proportional to this amount. It will also, for any increased volume, be inversely proportional to that volume. In the ordinary formula connecting the volume pressure and temperature of a perfect gas, $pv=R\tau$, we have only to suitably change the value of R to be able to write $pv=R'W'$ where W' is the converter quantity of energy referred to in the law, which we have stored up in the molecules to act as the agent or instrument for the conversion of heat into work, or *vice versa*.

We wish to emphasize this point, — just as the animal cannot perform its functions without life, so it is this stored-up energy which is the real agent in the engine. Rankine says, "The effect of the presence in a substance of a quantity of actual energy in causing transformation of energy, is the sum of the effects of all its parts." Here he distinctly represents energy as the agent for the transformation of energy.

I believe that nothing but energy can thus act, and that the general law underlying transformations of energy may perhaps be thus stated: "Every conversion of energy from a form A into a form B can be effected only through the agency of a quantity of energy," (and I venture to add) and this agent or converter quantity must possess at once the characteristics of A and B.

In the engine the agent possesses temperature and pressure, — the characteristics of heat and work: in the dynamo the field is characterized by both electrical and mechanical tension.

Now our agent-quantity of heat must act without expense to itself, for this is the peculiarity of agents; therefore the expansion must be isothermal: a source of heat at the temperature $\tau + d\tau$ being applied to the conducting bottom, the gas will then expand without loss of energy from the volume unity to the volume v, thereby converting a quantity of heat into work, which will be infinite for an infinite volume. For any given change of volume, the amount of work will be proportional to the pressure; that is, to the amount of agent-energy: so that for such a change the truth of the law is seen.

Let us look now at the behavior of the molecules: as each rebounds from the hot bottom, its stock of agent-energy receives into itself a portion of the heat W which is to be converted into work; i.e., the molecule is driven away with an increased velocity by the hotter molecules of the bottom; it carries this portion to the piston, to which it gives it up in the form of work, because if the piston be moving with a velocity V, the molecule will rebound from it with its velocity reduced by $2\,V$. As the volume increases, the pressure must fall, on account of the rebounds becoming less frequent, and the heat will be converted into work more slowly; but for any and all particular changes of volume, the rate of conversion will be in proportion to the amount of agent-energy, and, therefore, to the temperature of the gas. It is interesting, also, to notice that the distance (from the bottom to the piston), over which the heat-energy W must be carried, increases directly with the volume; and therefore the time required to carry a certain amount will be proportionately increased, the only way to obtain a more rapid conversion being evidently to increase the velocity of the molecules; i.e. the amount of agent-energy.

Let us turn now to Rankine: he is most easily understood if we commence with his 'general law for the transformation of energy,' already quoted, and proceed backward; and we come first to a graphical representation of the second law. After explaining the quantities in his diagram, and the known relations between them, he asks us to suppose the temperature τ to be divided into n equal parts. Should this supposition be difficult to make, we have only to remember that τ is the temperature of the agent, and, therefore, the amount of agent-energy in terms of a suitable unit; in fact, the statement that a unit mass of gas possesses a temperature τ, is equivalent to saying that it possesses τ units of energy, the unit being the energy required to raise this amount of gas one degree in temperature. We are to suppose, then, the agent-energy divided into n equal parts; and we are afterward told that these parts are 'similar and similarly circumstanced.' Now let us suppose a molecule, at the temperature $\tau=0$, to be heated to the temperature τ by the addition of n equal increments of energy; once added, all distinction between these parts vanishes, and there remains only the conception of the whole amount of energy as consisting necessarily of n smaller amounts; and the effects of all these amounts will be the same, and the sum of their effects the effect of the whole. It is only upon the thermometer-scale that degrees of temperature have special places, and that the last one added, and the first subtracted, must be the top one: we cannot, however, see any way in which the energy last added must be the same as the first subtracted.

In Rankine's graphical treatment he shows isothermal expansion; and it should be emphasized that it is the only expansion suitable for the conversion of heat into work, or *vice versa*. With adiabatic expansion we have nothing to do: its only use is to alter the amount of agent-energy, and it need not be used until we come to engines working in a cycle.

Rankine's next statement of his law is the second one criticised by Maxwell, and it supposes nothing more than the division of the absolute temperature already discussed. The first formula should, however, read

$$\tau \frac{d}{d\tau} = Q \frac{d}{dQ}.$$

Proceeding backward, we come to a seemingly more general and comprehensible statement of the law, which speaks of 'the total actual heat.' Now, Rankine has, I think, sufficiently defined this; and it is simply the kinetic energy of the molecules, or that portion of the heat furnished which remains as heat.

Inasmuch as the first statement of the law seems more general, insomuch has it led, as I believe, to a false comprehension of its meaning. It may seem more general in this way: —

Let x, in a system of rectangular coördinates, represent mass, and y absolute temperature, then the area, xy, will be proportional to the energy, or, with a suitable unit of temperature, will equal it. Now, we may cut this area into n equal parts by vertical lines, which will also cut the mass into n equal parts. In such case it requires no scientific imagination to see that these parts are similar and 'similarly circumstanced;' but this is altogether too simple for the use to be made of it, and no such statement can pass for a law of thermodynamics; it is simply the law of homogeneousness.

Rankine leads up to his statement in an unfortunate way, perhaps, emphasizing the fact that every particle is equally hot. Well, so it must be, or the upper line of the figure would not exist, or would be curved, which would interfere with the argument, because there would then be no one temperature for all the molecules. But Rankine intended no such vertical subdivision: in fact, he says, 'Let unity of weight,' etc.; and we may take a differential unit, and so put such a division out of the question. The division intended by Rankine was by horizontal lines, which makes the statement of the law identical with the other: only he says here, 'heat;' and there, 'temperature;' and he commences with heat, because heat is energy, and changes to temperature, because temperature is the practical way of estimating this energy, and is proportional to it.

We believe, then, that this is the one and only second law; and as our agent is a quantity of energy, and as energy resides in mass, whereas different substances do not differ in their mass, therefore the particular working substance used has no effect.

We will now look again at the formula for efficiency, which flows directly from Rankine's law, in a simple and evident manner.

If we could make an infinite-cylinder engine, this formula would not be needed. This engine works *at* a temperature, not *between* two temperatures, and it transforms all the heat into work. But mechanical considerations require us to build engines that run in cycles, and we then need it. Every engine running in a cycle is a double engine, consisting of an engine proper and a condenser; i.e., while the piston rises in the cylinder, which we cannot make infinitely high, we transform heat into work completely: then we must use our engine as a condenser for recompressing the gas; and, while doing so, we transform work completely into heat; and if we lower the temperature of the gas before compressing it, there remains a margin of work, according to the efficiency formula.

It should be remarked, that we have made no special reference in this address to any thing but a perfect-gas engine; and we believe the theory of this should be made clear before introducing the necessary modifications to include liquids and solids: Rankine has, however, framed his formula to cover both. Many other points have been left untouched; but if I have made plainer how heat, and therefore temperature, may be supposed to consist of any number of equal parts, and convinced you that Rankine's is the real and only second law, my main object will have been accomplished.

PROCEEDINGS OF THE SECTION OF MECHANICAL SCIENCE.

The valuable work done by a few in this section deserves the special recognition and support of all its members. The four divisions under which this work may be classified, embrace wide and interesting fields of thought and study. These divisions are, Technical education, Accurate standards of measurement, General, scientific and practical engineering work, and Original investigation. These are proper lines of work for the advancement of 'mechanical science and engineering,' because they include the education of men for the work; the production of instruments and appliances suited to the work; excite enthusiasm, and diffuse knowledge, among the workers; and enlarge the realm subjected to the exact knowledge and control of the intellect and will of man.

The first paper read before this section was on the strength of stay-bolts in boilers, and gave an account of experiments by the writer, Mr. L. S. Randolph. These experiments were designed to furnish data for the explanation of the peculiar manner in which the stay-bolts between the fire-box and boiler-shell had been found to break. The theory was, that the extreme difference of temperature liable to occur between the parallel plates — being at times 200° F., — caused a shifting of these plates, parallel to one another, sufficient to bend the stay-bolts considerably; and that this bending, occurring near the surface of the plate into which the bolt is screwed, caused the bolts to break at this point. The amount of such bending having been calculated from the known difference of temperature and the length of the plates, the experiments showed that if similar stay-bolts were subjected to this amount of bending, they would ultimately break, thus, apparently, confirming the theory. In the discussion, different forms of bolts or stays were suggested as likely to remedy the difficulty. The adoption of a link in place of a bolt was thought to be impracticable in this case on account of the small distance between the plates. Proportioning the stays so as to enable them to bend under the stress to which they are subjected without reaching the elastic limit of the material, was suggested as a remedy for the difficulty. It was shown that stays are sometimes worn away by being vibrated or bent. This bending causes the scale which has been formed to be thrown off; and oxidation occurring again under the action of the water, this new scale is thrown off, and this process continued wears away or 'channels' the iron.

A short abstract of a paper on a universal form of pressure-motor by Prof. D. P. Todd was presented by

ecretary. The abstract enumerated the advan- of the arrangement of multiple radial cylinders, istons of which act upon the inside of a vibrat- ccentric. In the discussion, several novel forms is kind of motor were recalled, as having been or tried; but it was shown, that thus far the ntages claimed had not usually been sufficient ounteract the objection of complicated construc- . Being best adapted for slow speeds, these mo- are not economical for steam on account of ssive cylinder condensation.

e subject of the next paper, by Mr. Stephen S. ht, was the use and value of accurate standards surveyors' chains. The chain described was of ened steel-wire, with thermometer attached to rd temperature, a spring-balance to weigh the ion under which the chain is used, and a spirit- l. Professor Davis exhibited a tape, such as his rience had proved to be practical for ordinary k, and which, though not capable of so great racy, perhaps, as the one described by Mr. ht, he had found amply so for general use in a e range of work in the state of Michigan. Pro- or Davis also exhibited a reel of simple construc- . The president read some notes from Prof. W. Rogers, chairman of a committee on standards of surement. These notes contained one suggestion ting to greater precision in the use of calipers. hops are coming more into the practice of having -rooms, Professor Rogers proposes to have a com- tor in the tool-room of each shop, and to have calipers sent to this room to be nicely set to exact , thus eliminating the errors so sure to exist er the ordinary methods. The fact, that some als and alloys when subjected to change of tem- ture do not return to their original volume when normal temperature is restored, was mentioned possible cause of variation in standard measures, fault of adjustment in instruments of precision e of such metals. Iron does not show this prop- of a 'set' in the ordinary range of temperature in which such instruments are used. The com- ee on accurate standards was continued for her year.

short paper by Prof. J. B. Webb, on the lathe as nstrument of precision, called attenion to the in most lathes of that exactness of construction ired to give a lathe the 'fine sense' of precision ch some instruments possess, so that it is usually achine for the economic removal of metal, rather for the production of exact forms. There is at ent no uniform method or available apparatus which a purchaser may test the degree of error in given lathe. Some simple methods for making tests were briefly described. Another paper by same author, on the economy of accurate stand- , set forth the increased money-value of such les as machine-bolts, screws, etc., when nicely d by accurate standards.

paper by Mr. C. J. H. Woodbury, on the co- ent of efflux of automatic sprinklers, described e sprinklers, which are devices for extinguishing . The sprinklers are attached to pipes, and the water is automatically let on to the sprinklers by the melting of solder under the action of heat caused by the fire. It often happens that the pipes conveying the water to the sprinklers are too small to deliver the required volume of water. The paper gave the results of the author's experiments for determining the coefficient of efflux, and the formula for discharge of automatic sprinklers attached to commercial fittings; also the means of determining the number of sprinklers on given pipes, which will make the losses due to friction approximately equal, and not so great as to impair the efficiency of the apparatus. In the discussion, various methods of preventing the freezing of the water in winter were described, a simple one being to fill the exposed pipes with compressed air. This involves careful fitting of joints and valve-stems. This has been done so successfully as to show a loss of only two pounds' pressure per week from leakage. Where an air-tight tank is used, the compressed air may fill the space above the water in the tank as well as the exposed pipes. In this case, there need be no valve or mechanism between the tank and the sprinkler; and when the passage to the sprinkler is automatically opened, the air in the pipe first rushes out, followed by the water which is forced out by the pressure of the air in the tank.

Mr. Frank C. Wagner presented an elaborate paper on electric-light tests, giving an account of his work in testing the efficiency of two electric-light plants.

Prof. M. E. Cooley explained and illustrated a method of testing indicator-springs. The method consists in placing a small rigid rod in a vertical position, with its lower end resting upon a standard-scale. Upon the upper end of the rod, the under side of the piston of the indicator rests. The indicator is fastened to a horizontal bar movable on vertical guides. When this bar is pressed down by means of thumb-screws upon the guide-rods, the pressure on the piston, and, consequently, on the spring of the indicator, can be weighed upon the scales, and the position of the pencil recorded by a mark upon the card. Experiments made when the spring was heated nearly to 212°, showed that the resistance of a sixty-pound spring was diminished about one pound by change of temperature. Professor Cooley also explained a new smoke-burning device, consisting of a rectangular slot through each door of the furnace, just above the level of the hot coals, and two three-eighths of an inch steam-pipes entering the furnace above the doors, and so directed that a jet of steam passing through them strikes the fire about two feet back of the door. As the air passes in through the slots, and over the live coals, it becomes heated; and when it meets the steam-jets, is thoroughly mixed with the products of combustion, and completely oxidizes them. The only condition requiring careful attention is that live coals shall be kept at the front of the furnace, and nearly on a level with the slots in the doors.

In a paper entitled 'Deep water at Galveston, Tex., and how to secure it,' Dr. Alexander Hogg advocated the construction of a break-water extending out two miles from the shore as the best solution of the problem. From the discussion, it

appeared that the ocean-bed at that coast is a shifting quick-sand, and some doubt prevailed as to the practicability of such a structure at any reasonable cost.

Prof. R. H. Thurston's paper on cylinder condensation was of great scientific and practical value. The fact, the manner, and the effect of condensation in steam-cylinders, were made clear, even to those but little acquainted with the subject. Nearly all the losses met with in steam-engines are due to this cause. Watt found that three-fourths of the steam used in his engine was lost by condensation. In ordinary engines of modern construction, about twenty-five per cent is the usual loss; while in some large engines this loss has been reduced to ten or fifteen per cent. This waste depends upon the temperature of the surface of the cylinder when the steam enters, the temperature of this surface when the steam is exhausted, the extent of surface exposed, and the time of a revolution of the engine. These four variable elements bear different relations to each other in different engines operating under unlike conditions. The engineer has at present no means of designing an engine for given conditions for which he can calculate just what will be the waste, due to condensation from these causes. The complete solution of the problem requires that experiments be made, first, to ascertain the variation of loss due to a change of one of these quantities, all the others remaining constant, and that the law of such variation be mathematically expressed. A second of these variables is treated in the same manner; and so on until the law of variation of loss, due to change in each one of these variables, has been expressed. Then, if it be possible to combine all these results into a single formula, this formula will express the complete theory, and give the full solution of the problem. These experiments were made with a Harris-Corliss engine, capable of developing over five hundred horse-power. The engine was controlled by a large brake constructed for this purpose. Curves were plotted, representing the results of the different series of experiments recorded. While the full solution of the problem undertaken may involve the necessity of further experiments, the results tabulated in this paper will prove of great value to engineers. The paper will soon be in print.

A description of the large Prony-brake used in the experiments just referred to, formed the subject of a short paper by the same author. The size of this brake, and the extraordinary requirements made upon it, viz., that of transforming five-hundred horse-power of mechanical energy into heat, and giving up this heat with sufficient rapidity to prevent the undue heating of the machine, were the principal features of the device.

The discussion on the best methods of teaching mechanical engineering was opened by the report of a committee, through Prof. J. B. Webb its chairman, who alluded to the discussion of the same subject by the Society of mechanical engineers at Atlantic City. That discussion showed that engineers desire that technical schools shall give thorough preparation in theory and principles; and, also, that they insist upon the importance of such practical knowledge and skill — in all who are to direct men, and plan and execute work — as will enable the foreman or engineer to instruct, direct, and, if necessary, show his men how to do their work.

Prof. R. H. Thurston said that the training should be adapted to the work to be done. Therefore he favored classification into manual training-schools, schools of mechanic arts, and schools of engineering. A large proportion of the students who start at the beginning of the course will prove fitted to become workmen only, and may go from the manual training-school into a special course for some particular trade, or into the shop. Of the remainder, some will be able to do construction and simple designing, and might go from the school of mechanical arts into a special course preparing them for superintendents and directors of workmen. A few will have ability to become engineers; and should have, not only manual training and the mechanic arts, but, in addition, an unusually good knowledge of mathematics, applied mechanics, physics, including electricity, and some chemistry. Mechanical engineering requires a better knowledge of the physical sciences than any other profession. The higher a man goes, the better must be his knowledge of the use of tools. Teachers of engineering should be men who have had good training through a broad practical experience in the solution of engineering problems, and should have retained their theoretical knowledge by reading and study. Such men, at present, are rarely found.

Further discussion brought out the suggestions, that there are no manual training-schools where a boy can learn a trade before entering the higher schools; that the St. Louis and Chicago manual training-schools will not make workmen, and that probably not five per cent of their students will ever become workmen. These schools are appendices to the public schools, to give a general training by a different method. Technical schools try to crowd too much into four years. Principles should be taught upon which the man can build for himself. Men must know how to think, and they will be able to learn engineering. Practice is theory embodied; and, in so far as practical experience or work can aid theory, the two should be intimately mixed or blended from first to last. Manual training aids the judgment. Shop-work, interspersed with classical studies, would not diminish proficiency, and would add a valuable element. Shop-work at Michigan university is offered to all students, and is often elected by others than those studying engineering. Actual shop-work, too, is an efficient 'conceit killer.' More liberal preparation should be required for admission to technical schools. The important feature of the discussion was the advocacy of courses of study, leading one into the other, with natural stopping-places, each of which is a starting-point for some special trade, position or profession, adapted to the talent and ability of the individual student.

PROBLEMS IN THE STUDY OF COAL, WITH A SKETCH OF RECENT PROGRESS IN GEOLOGY.[1]

WE have again assembled in our annual council, to renew and extend our acquaintance with each other, to maintain and strengthen the *esprit de corps* which ought to characterize the workers in a common field, to share with each other the new facts and new conclusions that we have reached by the labors of the last year, *mente et malleo*, and especially to aid each other in securing larger and more symmetrical views of the truths we hold, by fraternal discussion, criticism, and correction.

To review the record of the last year, and gather up its most significant advances, would be appropriate to the occasion; but various limitations forbid me to undertake such a task in any formal way. Before entering, however, upon the discussion of the subject which I wish to present to you, I beg leave to call your attention to a few facts that seem to me of special interest; and also to point out, in like cursory manner, some of the special directions and subjects in which American geology seems to me to be showing the most activity and progress at the present time.

The history of the vertebrate life of the globe, as far as it is now written, indisputably owes some of its most interesting and important chapters to American geology; but up to the last year we were still obliged to recognize the Ludlow rocks of Great Britain as the depositories of its earliest known forms. The recent fortunate discovery of the pteraspidian type of fishes in the Onondaga group of central Pennsylvania, by our associate, Prof. E. W. Claypole, has, however, granted us an equal date, at least, with the Scaphaspis of the lower Ludlow; and a fair argument can be made as to the somewhat greater antiquity of the Pennsylvania forms. This argument it is not necessary to press; for it loses its point and interest in the light of Professor Claypole's subsequent discovery of well-marked scales and spines of fishes in the iron sandstone of the middle Clinton group of central Pennsylvania. Onchus Clintoni of Claypole must enjoy the distinction, at least for a little time, of being recorded as the earliest representative of the vertebrate life of the globe.

But the 'earliest vertebrate' always sits on a precarious throne. At any moment the title is liable to lapse. To see its horizon suddenly descend several thousand feet in the scale, scarcely awakens our surprise. The abrupt appearance, the great numbers and the comparatively high organization of the earliest American fishes heretofore known, all demand a long antecedent history; and it is therefore no unwelcome labor to erase the old boundaries, and to draw the new ones, in such a way as to gain protracted ages for the unfolding and development of the type.

Another fact in the history of vertebrate life, acquired during the past year, deserves special mention here. Mr. Samuel Garman has recently published a description of a living shark that proves to be a cladodont, and so nearly allied to the genus Cladodus of carboniferous time, that it might with little violence be referred thereto. According to present knowledge, the family of cladodonts originated in the middle Devonian; and the genus Cladodus, as we have hitherto been obliged to hold, became extinct in the same age that gave it birth: but the chance-catch of a Japanese fisherman gives us an unmistakable cladodont, if not a true Cladodus, to-day; and in it we find 'the oldest living type of vertebrates.' The gap is far wider than any that has been heretofore bridged.

The discovery during the last year of fossil scorpions in three quite widely separated portions of the world at horizons approximately identical, and at the same time vastly lower than any in which they had been found hitherto, is a fact of much geological interest and significance. These three specimens from the upper Silurian effect an immense extension of the history of the tribe to which they belong, but each of them still falls short of the title of the 'earliest known land-animal.' That distinction is, for the present, held by the representative of an allied division. From well-characterized strata of middle Silurian age in central France, there was obtained during the past year the fragment of a cockroach's wing. It is a surprise to find Blatta, for the time being, at the head of the line of the inhabitants of the dry land.

Within the last year our associate, Mr. C. D. Walcott, has published a description of two species of pulmoniferous mollusks from the lower portion of the carboniferous rocks of Nevada. Both belong to the aquatic section of the Pulmonifera, and constitute the sole known representatives of that group in paleozoic time. One of them is a true Physa, and thus gives to this humble form a vast antiquity.

But leaving, without further notice, these very suggestive facts, let us barely glance, in passing, at some of the chief features in the advance of geological knowledge among us at the present time.

In the first place, stratigraphical geology appears to me to be attaining a somewhat juster recognition than has hitherto prevailed. It has been made very clear, that the work of the paleontologist is still too incomplete to allow any off-hand settlement of many of the questions that arise, by his determinations. There has been, in my judgment, an undue tendency to settle all questions as to the age and order of the several strata of any considerable series by the testimony of a few fossils. In the second place, the growing use of the microscope in geology is to be noted as one of the directions in which progress is apparent and marked. There is scarcely a field of research in which the service of the thin section is not now acknowledged and invoked. By it most of the varied claimants to the early life of the globe must be tried; and by it, as well, the minerals of the igneous and metamorphic rocks must be finally determined. Let us glance next with equal brevity at two

[1] Abstract of an address delivered before the section of geology and geography of the American association for the advancement of science, at Ann Arbor, Aug. 26, by Professor EDWARD ORTON, State geologist of Ohio, vice-president of the section.

or three of the fields of American geology in which special activity now prevails.

I have already called your attention to the beginnings of vertebrate life on this continent, but it is not in this fact that the chief interest of our vertebrate geology is found. It is in the later stages and higher forms of vertebrate life that American geology holds an easy and undisputed pre-eminence. Along the eastern slopes of the Rocky Mountains, there are being disentombed the remnants of great faunas of cretaceous and tertiary time that are quite without parallel in the history of geology. While these faunas are remarkable for the great number and variety of the species and individuals, and also for the enormous size of some of their forms, it is in other directions that their highest interest lies. By their anomalous and altogether unexpected characters, by their strange combination and dissociation of peculiarities of structure, they throw a flood of light on the question of evolution, and give us a key to the development of the existing creation that, before their discovery, it was too much to expect that we should ever possess. Here are birds with teeth, here are reptiles without them. Here are animals in which the characters of both birds and reptiles are so blended that it is hard to tell on which side of the line they belong, or whether there is any line. Here are horses with four toes, and hogs that chew the cud.

The activity in the investigation of the so-called archaean rocks is 'known and read of all men;' but as to the progress to be reported I dare not affirm, for the smoke of battle still covers the field, and the clash of arms still fills the air. In no previous year has there been so large and varied an amount of publication upon all of the problems involved as in this; and the topics discussed cover the whole range, from the igneous fusion of the earth, to the formation of a recent volcanic cone. The discussions are characterized by great ability, but the conclusions reached are wide apart and irreconcilable. Eozoön still maintains the struggle for existence, but with apparently lessening chances of survival.

Glacial geology is still a field of decided activity and progress. The most recent of geological formations, the drift, is still the most anomalous and perplexing. We have less experience and direct observation that can be brought to bear on its mode of formation, than we have on oceanic deposits, or even on the outflows of igneous vents. But, little by little, we seem to be coming into substantial accord in regard to the general sequence of the events that constituted the glacial period. The luminous and fruitful theories of Croll, like Darwinism in biology, are permeating all our modern glacial literature.

The most important service that has been rendered in the American field is the recent mapping of the great moraine from the Atlantic border to Dakota. And in view of the facts which have thus been brought out, scepticism in regard to the former occupation of the northern portions of the continent by a sheet of land-ice moving southward would seem to be impossible to the candid mind. It is coming to appear that the glacial record of North America is, like the rest of its geological history, incomparably simpler and clearer than that of Europe; and both the order of events of the last ice-age, and the nature and mode of operation of the forces employed, can be studied to better advantage here than elsewhere in the world.

I wish now to bring before you a few of the *Unfinished problems relating to the geology and chemistry of coal.*

For the last fifty years, there has been no reasonable ground for doubt that coal is more or less metamorphosed vegetation, and that the plants which formed the coal grew where they are now found. Nearly every seam of coal is underlaid by a stratum of clay containing the well-known stigmaria, which have been proved to be the roots, or underground stems, of the lepidodendrid and sigillarid trees composing the coal; and hence it may be truly said that the rootlets of the stigmaria bind the coal-seams fast to the surface of the land. Most of the well-matured and more elaborate theories of coal agree still farther in holding that this vegetation grew on low lands, and not only near the sea-level, but near the sea itself. But as we advance beyond these generally accepted positions, we seem to find ourselves at once among the unsettled questions; for the particular conditions and modes of growth of the great sheets of coal vegetation are variously conceived and represented.

1°. Forests growing on swampy tracts, finally submerged, and buried under sheets of sand and clay, the forest trees themselves constituting the bulk of the coal: this is one of the earlier and cruder theories which it is somewhat surprising to find still surviving. 2°. An accumulation of vegetation, quite after the manner of the mangrove swamps of sub-tropical lands at the present time, makes another theory. Geikie adopts this as the best picture of the conditions of coal formation that we can find in the existing order of things. 3°. By Sir Charles Lyell, the cypress swamps of the lower Mississippi were made to do like service. 4°. Fifty years ago Brongniart made the suggestion, in an almost incidental way, that we should find in the peat-bogs of to-day the analogue and representative of the coal-seams. This suggestion has been living and growing ever since. A young Swiss naturalist was perhaps the first to expand it into a definite theory. He saw that the laws of the peat-bog could be applied to the coal-seam; that the only key to the history of the latter was to be found in the beds of fuel that are growing now, but whose roots go back into past millenniums. We should have had a glacier theory of the drift without Agassiz, a scientific geography without Guyot, and, in like manner, the peat-bog theory of coal would have found its way here without Lesquereux; but, historically, it fell to these three illustrious compatriots, fellow-students, and life-long friends, to lead the way, each in his own field, to these several great advances.

I have glanced at the problem of the coal-swamp, and the accumulation of a single seam; but these seams are combined in great systems with beds of

sandstone, conglomerate, shale, limestone, and iron-ore, to a thickness of hundreds and thousands of feet. We are confronted, then, with the problem of a *coal-field*, and bring to our interpretation of it the points already made; viz., that every seam was formed by vegetable growth in a swamp or bog near the sea-level. Subsidence of the coal-forming area must be invoked, and the swamps successively buried under marine sediments.

To see what some of the problems of a coal-field are, let us take a concrete case. The coal-field of eastern Ohio is by far the most orderly field that has ever been described. The regularity and simplicity of its structure make it the type for this whole class of formations. What, then, do we find in this, the simplest and most symmetrical, the least disturbed and complicated, of all known coal-fields? We find a maximum of two thousand feet of strata covering ten thousand square miles. There is a well marked rhythmical order of arrangement of these strata. The three kinds that represent the agency of life are always found in close proximity. Coal standing for the life of the land, limestone for the life of the sea, iron-ore, equally dependent on life for its separation and concentration, but blended with both limestone and coal, these form vital nodes in the series, relatively of small amount, but containing all the economic interest and value. The nodes are separated by the sandstone and shale, which are barren of life, and owe their accumulation to inorganic forces. Measured against the products of life, these inorganic sediments have a thickness of five or ten feet to one. But note, the intervals between the vital nodes are approximately equal. Turning now to the problems presented by this typical field, how can we explain the regularity of these intervals? One suggestion of an explanation is found in that unique contribution to modern science, Croll's 'Climate and time;' viz., that the carboniferous age was a period of high eccentricity, and that the coal-seams were formed during interglacial stages, — an astronomical cause for the recurrence of these cycles of life, that exhibit an almost astronomical rhythm and order, this is a light in a dark place, albeit the light is thus far but a feeble one.

But more important questions yet remain, involving the extent and reach of the several seams, and the laws of growth of the field as a whole. Were the lowest coal-seams formed over the entire area? and may we expect their presence in the central portions of the basin, if we descend deep enough? These questions, and others of like import, must be classed as open, although certain general propositions which it would be a pleasure to expand compel me to believe that they should not be answered in the affirmative.

On the chemical side, there are various unsettled questions pertaining to coal, some of which possess both theoretical and practical interest. But, although they are probably not insoluble, science must sink its roots deeper before it can give us full answers. The microscopic structure of coal is another field in which much remains to be done. It is what has been already done in this direction that gives us our grounds of confidence in regard to the vegetable origin of coal. But the relative importance and distinguishing characters of coals formed of carbonized vegetable tissue, of spores, and of hydrocarbons, are still undetermined.

In conclusion, we may be sure that the problems relating to coal which now rise before us as unfinished, will, sooner or later, find their solution. But when they are solved, will all be known? Nay, verily. Out of these old carboniferous swamps, new questions, larger, deeper, than any we now see, will perpetually arise to stimulate by their discovery, and to reward by their solution, that *love of knowledge for its own sake* which makes us men.

PROCEEDINGS OF THE SECTION OF GEOLOGY AND GEOGRAPHY.

THE section opened with the *éclat* of a masterly address by its chairman, and was continued with lively interest, and a fair attendance, which abated only on the last day of the session. Twenty-seven papers were read, and nearly all of those elicited appreciative and profitable discussion. Debate was never unduly warm, and, though full, rarely wandered from the text. The proper functions of the association were evenly exercised; all ideas were freely criticised; the isolated and retiring student was encouraged; the chronic talker was merciful; and the philosopher, who had evolved from his consciousness a perfect theory of the universe, was persuaded to defer its promulgation. In the distribution of the communications by topics, stratigraphy received the lion's share, rejoicing not only in the leading number of contributions, but in the most important paper of the session. The age of ice claimed less attention than usual, and the mysteries of the archaean were unassayed. The following summary of the proceedings, abandoning the order of sequence of the meeting, gives first place to the earth's crust as a whole, follows with its successive layers from lowest to highest, and closes with volcanism and mineralogy. Geography made no contribution to the programme of the section; but it furnished the only paper accepted by the association for presentation to the general meeting, — a lecture by Capt. E. L. Corthell, on the inter-oceanic problem, the substance of which has already appeared in *Science*.

When, in his celebrated essay, George Darwin deduced from the tidal retardation of the earth's rotation the theorem, that the ellipticity of the terrestrial figure has been diminished throughout geologic time, he omitted to make certain deductions in regard to

the earths' crust, — deductions by no means plain to the physicist who maintains the solidity of the globe, but scarcely avoidable by those who conceive of the solid crust as thin. Two Americans have independently complemented his theory in this respect, and it happened that their arguments were both submitted to the association. Professor Alexander Winchell presented a paper on the sources of trend and crustal surplusage in mountain structure; and, to his great surprise, was followed by the reading of a communication from Mr. William B. Taylor, on a probable cause of the shrinkage of the earth's crust, in which his treatment of surplusage was so closely duplicated that a single abstract may serve for both. Accepting the demonstration by Dutton and Fisher of the quantitative insufficiency of the so-called 'contractional hypothesis' of crust corrugation, and following Darwin in his conclusion that geologic time has witnessed a notable shortening of the equatorial diameter, and a corresponding lengthening of the polar, these gentlemen find in the change of figure a 'surplusage' and consequent 'shrinkage' of the crust. The readjustment of the crust to the less flattened spheroid involved not only a diminution of its area, but the institution of a system of shearing and other strains, calculated to wrinkle the surface in all parts except the polar regions; and to produce, what is actually observed, — a maximum effect within the zone of the equatorial bulge. The remaining half of Professor Winchell's paper, found in the lunar tidal influence an independent reason for the prevailing meridional trend of corrugations. He saw in the lagging of the tide a force tending to slip the tidal crust westward; and this would result, during the ages of crust formation, in an ingrained meridional structure, which would in turn determine the trend of subsequent folds consequent on surplusage.

Three discoveries of fossils were announced in what has been disputed ground at the base of the geologic column. Prof. N. H. Winchell brought from the pipestone-quarry of Minnesota a contorted trilobite of the Paradoxides type, and slabs of sandstone covered with round phosphatic brachiopods referred provisionally to Lingula. From these he inferred the pre-Potsdam and post-Huronian age of a great series of rocks in Minnesota and Wisconsin, including the cupriferous rocks of Lake Superior. Prof. William B. Dwight reported the discovery of a unique Potsdam locality one mile north-west of Vassar college, and in the Wappinger limestone belt. Among the fossils are Lingula primiformis, Lingula minima, Obolella, Conocephalites, and Dicellocephalus. A contribution was made to the veteran Taconic question by Prof. James D. Dana, who exhibited lower Silurian fossils taken at Canaan, N.Y., from the 'sparry limestone' of Emmons, a member of his original Taconic system as first defined by him in 1842. A short discussion followed, in which Professor James Hall said that the existence of Silurian fossils in these rocks was claimed and admitted forty years ago; and Prof. N. H. Winchell argued that Emmons's later use of the title Taconic, in which he applied it to certain rocks in New York, now known to be pre-Silurian, entitle the name to a place in stratigraphic nomenclature.

Professor Edward Orton described the gas and oil wells of north-western Ohio, dwelling especially on their contribution to stratigraphy. The district, as at present known, centres at Findlay, where the first success was achieved. The borings start in the water-lime and Niagara formations, quite below the Berea grit, the only rock from which the geologist would have ventured a year ago to predict a supply of gas. The exploration was incited by superficial indications, — the occurrence of gas in springs, superficial wells, etc., in the vicinity of Findlay. The flow of gas ranges in different wells from 100,000 to 1,200,000 cubic feet per day. The petroleum, which is not afforded in great amount, is black, sulphurous, and of about 35° gravity, — a description applying to all oils from limestones. The descending section, compiled from several well records, includes 275′ of Niagara limestone, 2′ to 6′ of Niagara shale, 30′ to 40′ of calcareous shale (Clinton), 200′ of red shale (Medina), 300′ to 400′ of calcareous shale (recognized by its fossils as Hudson River), 250′ to 275′ of brown shale with fossils (Utica), and 500′ of porous magnesian limestone identified as Trenton. This bears the gas and oil. One matter of note is, that the Hudson River and Utica groups of New York, which in southern Ohio are called 'Cincinnati' because they cannot be separated, are here individually recognized. Another is, that the Cincinnati arch, as illustrated by the attitude of the Trenton, lies farther west in northern Ohio than has been supposed. Its trend is nearly north-south.

The paper which commanded most attention was that of Prof. Henry S. Williams. While no single element of his method is novel, his work must nevertheless be recognized as a new departure; for none of our geologists have heretofore pursued comparative stratigraphy, and the comparative study of faunas, in so close combination, and in such detail. As the importance of the work will command for it, in the pages of *Science*, a fuller analysis than the necessary limits of this report permit, the present notice will be confined to an account of its scope and method. The area studied comprises the southern counties of New York, the adjoining counties of Pennsylvania, and northern Ohio as far as Cleveland. In this area numerous sections were studied, extending from the termination of the Hamilton group in the Genesee shale through the upper Devonian, and terminating upward with the conglomerate underlying the carboniferous. The examination of the sections extended to minute stratigraphic details; and the fossils from each stratum were kept separate, it being found that in rock series, involving alternations of beds lithologically different, there are usually corresponding alternations of distinct faunas. A failure to attend to this principle leads to the mingling of faunas, and consequent misconception; its recognition makes of each fauna an identifiable unit, which can be traced in its geographic distribution, and its successional development. It appears, for example, that the fauna of the black Genesee shale is repeated in every higher black shale of the column; and that, in its successive recur-

it exhibits an orderly series of modifications are parallel in different sections. Though its is discontinuous at any one locality, the life of na was continuous somewhere, its distribution ry epoch being determined by ever-shifting l conditions. Within the field of study are distinct faunas: *A*, the middle Devonian, or Hamilton, fauna; *B*, the fauna of the black *C*, the fauna of the green shales of the Portage *D*, the fauna of the brown shales and sand- of the Chemung group; *E*, the fauna of the a conglomerate; *F*, the fauna of the Catskill *G*, the fauna of the Waverly group. In each e, except *E* and *F*, from three to seven varia- re recognized, which have a successional order, designated 'stages.' In presenting his mate- rofessor Williams defined each stage, and d it a symbol, consisting of a letter and a num- A chart exhibited the local stratigraphic col- lrawn to scale, and in their proper geographic is, lithologic distinctions being expressed by and the faunal horizons indicated by their s, — a system of graphic presentation which aided the audience in comprehending the 's numerous inductions.

S. G. Williams reported observations on the of Cayuga Lake, at the outlet of Skaneateles nd at Oriskany Falls, leading to the conclu- at lower Helderberg rocks, other than those of ter-lime group, have a greater westward exten- New York than has heretofore been supposed. ames Hall called attention to the uniformity of ons indicated by the stratigraphic series in cen- w York, as compared with the varied history le from the exposures on the Hudson River; of. J. P. Lesley spoke of the 'infinite variability' Oriskany. Pennsylvania contains a thousand f its outcrop, in which its thickness oscillates ve hundred feet to nothing at all; and no two s agree. Mr. A. S. Tiffany gave an account corniferous group as it is exhibited in Scott , Iowa, and in Rock-Island, Ill.; and also of w sandstone at Burlington, Io., which he re- ith doubt, to the Chemung. From the first rted 246 species of fossils, and from the second ies.

problem of the origin of the paleozoic sedi- of Pennsylvania was discussed by Prof. E. W. le. Postulating that the material came from of Archaean rocks now exposed — or known rlie later formations — in south-eastern Penn- a, and adjacent portions of New Jersey and nd, he based a computation on the area and thickness of the sediments, and the area of umed district of derivation; and reached the ion that the Archaean district had suffered a tion of several vertical miles. Then, restrict- ention to the conglomerates of the paleozoic showed, that, on a moderate estimate, 36,000 miles of sediment contain an average of thirty vitreous, milky quartz, in the form of pebbles. rounding of these by attrition, a still greater y of quartz was disposed of; so that a truly immense amount must have existed in the district of denudation. The visible Archaean outcrops contain only a small amount of such quartz, and that is almost confined to a narrow belt of Huronian rocks in Pennsylania. It is probable, therefore, that the Huronian was better represented in the eroded mass of Archaean than it is in the surviving outcrops.

Prof. Lewis E. Hicks described the structure and relation of the Dakota group in Nebraska, maintaining that the actual eastern shore of the Dakota Sea is there recorded. The formation rests on an eroded surface of subcarboniferous limestone, the valleys of which were occupied by bays and gulfs of the Dakota Sea. It is noteworthy that the lines of post-carboniferous drainage were identical with the main lines of modern drainage, though the streams flowed in the opposite direction. It thus happens, that, despite the westerly dip, the eastern boundary of the Dakota has its salients in the east-sloping valleys of the existing topography. The average thickness of the formation is 400 feet: its average dip is six feet to the mile in the direction N. 70° W. It is not entirely, nor even predominantly, composed of sandstone, but contains a large amount of shale, with fire-clays, and, near the top, some lignite.

The first communication on the drift was the opening paper of the session, and introduced to the attention of the section the features of the local geology. As the phenomena Prof. A. Winchell described have long since passed into geologic literature, they need not be recited here; but he touched on a local economic subject which is well worthy of promulgation. Citizens of Ann Arbor have culled from the fields the larger crystalline erratics; and, breaking them into suitable shape, have built of them their finest edifices, public and private. The stones exhibit a variety and individuality which no quarry can rival; but the prevailing flesh-tints and grays blend harmoniously, and the effect is peculiarly agreeable to the eye. Prof. A. H. Worthen described the quaternary deposits of central and southern Illinois, taking for his text the sections afforded by a number of coal-shafts traversing the superficial deposits. The bed-rock surface is diversified by valleys very much as is the drift-surface above, but with a different drainage system. The drift-section is, therefore, variable in thickness, but the sequence of its members is approximately uniform. At bottom is a stratified clay, in part gravelly; and, as judged by its composition, this is derived from the waste or decay of the bed-rock of the immediate vicinity. Then comes a forest-bed — not a universal feature, but so widely spread as to render the well-water of large districts unfit for use. Over this lies a blue and yellow gravelly clay, with glaciated bowlders ranging up to two feet in diameter; then a few feet of loess, and finally a thin bed of fine clay. These deposits do not point to glacial ice alone as an agent. They indicate water also, and the lowest member is either sedimentary or alluvial. Prof. John C. Branner gave an account of the glaciation of the Lackawanna valley, where the same rock-surfaces bear striae in systems diverging from 20° to 40,° and in one instance even 120°. These are

explained by the consideration, that, when the great ice sheet was most extended, its local depth was great as compared to the height of the mountain ridges, and it traversed them obliquely with little or no deflection; but, as its extent and depth diminished, it yielded more and more to the control of the topography. Prof. E. W. Claypole pointed out, that, granting this explanation, a strong argument was afforded against the theory that ice is a great agent of erosion. If the erosion of the later epoch was too feeble to efface the scratches left by the earlier, we cannot reasonably regard the earlier erosion as great. Mr. William McAdams, who last year exhibited bones from the loess at Alton, Ill., announced further discoveries of the same nature, and described the superficial deposits of the region. The list of species now includes mastodon, ox, deer, megalonyx, beaver of several species, gopher, ground-hog, bear, and an animal allied to the wolf.

A phase of post-glacial geology was treated by Mr. G. K. Gilbert, who has recently traced an old shore-line of Lake Ontario half way about its basin. From Hamilton, Can., to Sodus, N.Y., it runs parallel to the modern shore. It then turns southward, and deviously outlines a great bay, studded with islands, which occupied the basin of the Oswego River and its branches from Lyons to Rome, and sent a narrow arm to Cayuga Lake. East of Lake Ontario it is once more parallel to the modern shore. The outlet was then at Rome, and the discharge flowed down the Mohawk valley. The plane of the old water-surface is no longer horizontal, but inclines southward, with an average slope of about four feet to the mile, and westward more gently. At Adams Centre, in Jefferson county, it is 650′ above tide; on the north shore of Oneida Lake, 480′; along the Erie canal south of the lake, 430′; near Rochester, 423′; at Hamilton, 350′. It passes beneath the water of Cayuga Lake near its north end. Subsequent to the epoch of this shore-line, the water-surface of Lake Ontario was depressed below its present, as is shown by many of its bays, which occupy valleys wrought by post-glacial stream erosion. Mr. Gilbert's working hypothesis is, that the shore-mark associated with the Rome outlet records an epoch in which the retreating ice-sheet still occupied the St. Lawrence valley. The northern side of the basin was then relatively depressed; and when the water finally escaped past the ice at the north-east margin of the basin, its surface rapidly fell to a position below the present shore. The existing system of levels has been effected by subsequent crust movements.

A paper by Prof. Frederick D. Chester, on the gabbros and amphibolites of Delaware, was read by title, and will be published in the proceedings. Prof. A. R. Crandall gave an account of some small volcanic dikes, recently discovered in Elliot county, Kentucky. The surrounding strata lie nearly level, and the locality is about ninety miles north-west of the nearest Appalachian dislocation. The dikes do not impress their form on the topography, but have yielded to decay along with the enclosing carboniferous strata. Prof. L. E. Hicks remarked that he had observed on the White River in Nebraska a dike which resembles these, in that it is associated with no disturbance of the sedimentary rocks.

Mr. George F. Kunz briefly described a new mass of meteoric iron from Carlestown, W. Va., and read a series of notes on minerals from new localities, or otherwise interesting. Among them were native antimony from Prince William, N. B.; tourmaline from Rumford, Me.; a pseudomorph of felspar after leucite (?) from Magnet Cove, Ark.; a curious form of beryl from Auburn, Me.; a capped garnet from Raymond in the same state; and a turquoise from New Mexico, artificially stained to produce a favorite blue shade. He described, also, a collection of rough diamonds, temporarily in the possession of Messrs. Tiffany & Co., bringing out especially the fact, that the convex curves of some rough diamonds are not referable to attrition, since only the diamond can wear the diamond, but are made up of crystalline facets. A paper by Dr. T. Sterry Hunt, on the apatite deposits of the Laurentian rocks, was read by abstract.

EDUCATIONAL MUSEUMS OF VERTEBRATES.[1]

From what is known of man's present constitution and environment, and from what is commonly believed respecting his future form, condition, and associates, it seems to follow that all kinds and degrees of zoölogical instruction, whether anatomical, histological, physiological, pathological, psychological, or religious, should be based upon some knowledge of vertebrated animals. As aiding to make this knowledge real and lasting, every educational institution, of whatever grade, should have a vertebrate museum.

From many vertebrate collections the average visitor carries away, besides the sense of fatigue, certain impressions which are inadequate or erroneous, or, if correct, uncomplimentary.

The following plans and methods are followed in a preliminary re-arrangement of the vertebrate collections at Cornell university: The exhibition-cases should contain only specimens which can instruct or interest the visitor. Not only should facts be displayed, but fundamental principles should be illustrated. There should not only be special series of embryos, brains, hearts, etc., but such preparations should be associated, to a certain extent, with the animals to which they belong. Preparations illustrating important facts should retain so much of the entire animal as may facilitate recognition and association; when this is inconvenient, the preparation may be accompanied by a figure of the animal. When the relative rank of several forms is well determined, the lower or more generalized should be placed below or at the left, and the higher or more specialized

[1] Abstract of an address delivered before the section of biology of the American association for the advancement of science, at Ann Arbor, Aug. 26, by Dr. Burt G. Wilder of Cornell university, vice-president of the section.

above or at the right. As a rule, each specimen should teach but one thing, and that thoroughly. The same form may, therefore, properly recur in several parts of the museum, to illustrate different parts or ideas. Quality is more important than quantity, and arrangement is usually more needed than acquisition. True economy consists in paying liberally for what is wanted, rather than in taking what is not wanted as a gift. The usefulness of a specimen, and thus its real value, is to be measured, not by its rarity or cost, but by the degree in which it exemplifies important facts or ideas. Many specimens should not only be labelled, but also accompanied by figures and explanations.

In addition to, or more often in place of, the three great series — physiological, taxonomic, and geographical — which are commonly attempted in museums, but which it is rarely possible to complete, specimens representing an equal amount of time or money would have a higher educational value if divided among a considerable number of special series, each illustrating some morphological or teleological principle.

Some of these series are strictly artificial, yet useful; as, e.g., animals exterminated by man; those which supply us with food, medicine, weapons, clothing, or materials for habitation; fabulous, mythical, and sacred animals; and those which are mentioned by Shakespeare, and in the Scriptures.

Of natural series, the most conspicuous and complete should be the *vertebrate branch synopsis:* this should embrace, within a space easily covered by the eye, one stuffed example or model of a species representing each vertebrate class, together with four preparations exhibiting the vertebrate type of structure; viz., a transection of the whole body; a hemisection of the whole body; a complete vertebral segment; a hemisected skeleton showing the variation in size of the neural and haemal cavities. So far as possible, these preparations should be made from members of different orders of the class, and be accompanied by outline diagrams and explanations.

Each class, but first and especially the mammalian, should have its own special synoptic series, embracing one or more entire examples of each order, and preparations illustrating the characters of the class. The choice and arrangement of these preparations are complicated by the desirability of indicating that what are commonly enumerated as class characters are of unequal degree: some are constant and peculiar; some constant, but not peculiar; others peculiar, but not constant; and others, again, though usual, are neither peculiar nor constant. The neglect to indicate these differences in lectures, text-books, and museums gives rise to inaccuracy or uncertainty in the minds of students.

Instead of vainly attempting to obtain and exhibit all the species of all the groups, most educational museums would attain more satisfactory results by selecting the more interesting or instructive forms from all classes, and limiting their efforts to complete groups for a few, upon which, as well as upon a larger number, may be illustrated the principles of classification, and of individual and geographical variation.

Among special series other than systematic, are *analogous forms and structures* which are sometimes mistaken for one another, but more readily discriminated when brought together. Such series are the rostrated animals, spinous forms, and those which have parachutes. *Physiological series* would contain the hibernating animals, those which are blind or nearly so, and such as are provided with scent-glands, tusks, and all poisonous vertebrates.

A *local collection* should embrace all the animals of the vicinity, and will benefit the student, both as an example for him to follow or improve upon, and as exemplifying the laws of geographical distribution and the influence of environment. The local collection need not contain anatomical preparations, but should exhibit both sexes, and all stages of growth of each species, — its mode of life, friends and foes, — so as to interest also the children, farmers, fishermen, hunters, and other residents of the neighborhood.

Special attention should be called to existing deficiencies, not only in the local collection but in all parts of the museum; and graduates or other friends of the institution should be reminded of the opportunities, often peculiar, which they may have of supplying desiderata.

Although more than a quarter of a century has passed since the modern scientific doctrines respecting the methods of creation began to be accepted; although opposition to the general idea of organic evolution is now nearly confined to the stubborn and ill-informed; and although its substantial truth is tacitly admitted, or openly claimed, in nine out of ten higher educational institutions in this country, — I have yet to learn that any considerable part of a college museum has been specifically devoted to the exhibition of the facts which are described or figured in most zoölogical manuals, and in many works upon popular science.

Such a collection should embrace much more than a few ape-skeletons hung beside that of man. To avoid the appearance of dogmatism, let me briefly mention the various series relating to evolution which have been begun at Cornell university: Simple ontogenetic series, exemplifying the extent and rapidity of individual transformation; comparative ontogenetic series, illustrating the resemblance between successive stages of one form and the adult conditions of others; generalized, synthetic, or intermediate forms, or 'connecting links;' forms supposed to have degenerated; apparently useless or even hurtful organs or conditions; apparently needless rules, with equally unaccountable exceptions thereto; human peculiarities, not only as to the skeleton, but as to the brain, heart and other organs; human resemblances to mammals in general; features which unite man with the tailless apes, and separate them all from the other mammals; transitory human organs and conditions which resemble the permanent organs and conditions of other mammals, especially apes; human anomalies resembling the normal structures of apes; anomalies and malformations affecting

man and other vertebrates in a similar manner; evidences of accident and disease among wild animals.

Presumed lines of human descent may be indicated better than by diagrams upon a plane surface, by placing actual representatives of the various groups, not upon fixed shelves, but upon brackets capable of adjustment.

The candid teacher or curator will endeavor to show not only the facts which seem to support evolution, but also those which constitute its difficulties.

A statue of Darwin has recently been unveiled in London with honorable ceremonies. What monument to his memory could be more appropriate or lasting than the formation, in all educational institutions, of collections especially designed to exhibit the facts which he made significant, and the ideas which his knowledge, his industry, and his honesty have caused to underlie the intelligent study of nature throughout the world?

PROCEEDINGS OF THE SECTION OF BIOLOGY.

The biological section opened with two papers by Prof. E. L. Sturtevant as the result of observations and experiments at the New-York agricultural experiment station. The first, on the hybridization and cross-fertilization of plants, showed in a conclusive manner that in our common vegetables (peas, corn, beans, barley, lettuce, are some of the forms experimented with), cross-fertilization tends toward atavism rather than to a blending of individual properties of the parent plants. As a rule, all the crosses tended to revert to an ancestral form, regaining in many cases characters which the immediate parent had lost. The paper forms a valuable contribution to the subject of the origin of species, on account of the carefulness of experiment and accuracy of observation apparent in the work. In the second, 'Germination studies,' the author states, as a result of many trials with commercial seeds of our common plants, that very extended series of trials must be made with each species in order to obtain the desired accuracy in results; since in a short series of trials many errors will probably occur which would be eliminated from the final result by the use of a larger series. Prof. W. J. Beal of the Michigan agricultural college described an experiment on the longevity and endurance of seeds — in which ripe seeds were buried in sand below frost for five years, at the end of which time they were exposed to frost for a period of two years and a half more.

An interesting paper on the biological deductions to be drawn from a comparative study of the influence of cocaine and atropine on the organs of circulation, was given by Dr. H. G. Berger, U.S.N. The generally accepted opinions regarding the use of atropine, muscarine and cocaine, on the organs of circulation, are, that atropine induces an augmentation and acceleration of the circulation by paralyzing the vagus nerve-endings in the substance of the heart; and that muscarine, by acting as a stimulus to the same nerve-endings, produces diastolic arrest. The later view of Glouse, however, is, that the arrest is due to its paralyzing influence on the muscles of the heart. The main points in these two views are, 1°, that the action is purely a nervous phenomenon; 2°, that it is purely muscular. When atropized blood is put into a frog's heart, the organ is first highly stimulated, but shows evidence of exhaustion by over-stimulation; this is associated with a break in the rhythm of the beats, the auricles contracting two to three times oftener per minute than the ventricles: the dose of atropine can be so regulated that this unrhythmical action may be kept up indefinitely, and even be reproduced in a heart which has recovered from atropization in normal blood. The most rational explanation of this phenomenon is found in the facts, that, while muscarine paralyzes, atropine stimulates, the cardiac muscles as well as the cardiac nerve-endings; though in case of the latter only in a slight degree. Cocaine affects the nerve-endings within the heart much the same as atropine, but is not a muscular stimulant. From his researches, Dr. Berger reached the conclusion that the drugs used acted directly on the muscle-tissue, producing paralysis, and not indirectly through the nerve-endings, — a view which was combated by Profs. Charles A. Sewall and H. N. Martin in the discussion which followed the reading of the paper.

'On the brain and auditory organs of a Permian theromorph saurian' was the title of an interesting paper by Prof. E. D. Cope. The author called special attention to the morphology of the brain, the character of the cranial walls and the auditory apparatus. The characters of the brain were considered to show affinities to the reptilian and the simpler mammalian types. The corpora quadrigemini are small, and the cerebral hemispheres exceedingly small — relatively inferior in bulk to those of any other known animal. The epiphysis is larger than is usual for reptiles. The absence of an optic foramen is a very striking character. This form is peculiarly characterized by the presence of a large oval foramen in the frontal region, the exact nature of which has not been determined. The vestibule and its walls were thoroughly described, and the relations of the well-formed semicircular canals explained. The stapedial bone connects with the fenestra ovalis external to the brain case, and at a great distance from the cochlea — the cavity of which is a mere extension of the fenestra ovalis to the vestibule. The semicircular canals resemble those of modern reptiles.

Mr. A. W. Butler presented many interesting facts concerning the habits of the musk-rat. The author mentioned well-authenticated cases of the change of habits as a means of adapting itself to the changed conditions of life, — conditions brought about by the presence of civilized man.

The disputed question of the bisexuality of the pond-scums (Zygnemaceae) was discussed by Prof. C. E. Bessey of the University of Nebraska, who concluded that these organisms do not possess true bisexuality such as Bennett of England claims for

them. All the observed facts of the conjugation of these algae tend to prove that sexuality is in its beginning, but as yet there is no differentiation into male and female elements; so that we cannot speak of a bisexuality, although there is a union of two distinct bodies of protoplasm. One fact not observed by Bennett is that of the formation of a resting spore by union of the protoplasm of two adjacent cells of the same filament. The position of the Zygnemaceae is among the lower Thallophytes, but little above the Protophytes.

'On the process of cross-fertilization in Campanula americana' was the title of a paper presented by Prof. C. R. Barnes. In this strongly proterandrous species, the pollen is scraped out of the anthers, by the hairy style, at a period anterior to the maturation of the stigmas; before the occurrence of which, the pollen has disappeared from the style. In this manner cross-fertilization is rendered certain. The pollen develops normally. The stigmas are held together until mature by interlocking papillae. The hairs on the style become introverted, and thus free the pollen. The pollen-spore contains two nuclei, the larger of which (the vegetative) becomes disorganized shortly after entering the pollen-tube, the smaller (the spindle-shaped), generative nucleus persists. The embryo sac is cylindrical with a gradual enlargement near the upper end, where is located the egg apparatus, and an abrupt enlargement at the base in which lie the antipodal cells. The pollen-tubes enter the style between the bases of the papillae of the stigma, pass down in the strands of the conducting tissue, and not through the central canal around which the tissue is arranged.

Dr. C. V. Riley presented a paper on the song-notes of the periodical cicada, and the mechanism by which they are produced. The author gave the first accurate description of the three characteristic notes of the insect, noting the variations for the individual and for thermal and hygrometric conditions of the atmosphere. The same author, in another paper, corrected the erroneous notions, that var. Cassinii Fish represents the race tredecim Riley, and that the twigs containing the eggs necessarily break off before the hatching of the larvae.

In a paper on the proof that bacteria are the direct cause of the disease known as pear blight, Mr. J. C. Arthur demonstrated by the results of his carefully conducted experiments that, 1°. Sap from an infested tree when inoculated into a healthy tree invariably produced the disease called blight. 2°. When cultures to the sixth generation of organisms were made with all precaution to prevent error, and healthy trees were inoculated with the pure culture of this sixth generation, the tree is stricken with blight, starting from the point of inoculation, and gradually extending over the whole plant. 3°. That wherever there is a blight not produced by freezing, bacteria of this species are invariably present. In order to complete the value of this work, there yet remains to discover some certain method of prevention or cure.

A paper on aquatic respiration in soft-shelled turtles (Aspidonectes and Amyda) was presented by Profs. Simon H. and S. S. Phelps Gage as a contribution to the physiology of respiration in vertebrates. One of the characteristics by which reptiles are said to be distinguished from amphibians is, that their respiration is exclusively aerial at all periods of their life. This assertion is made by all authors, except Agassiz, who adds a slight qualification. On the strength of the experiments and observations of the authors, this general character must be given up, since they have demonstrated beyond a doubt that at least in the soft-shelled turtles respiration is normally and constantly carried on by means of a respiratory apparatus, whose essential features, physiologically considered, are those of a gill. There is here, as in the adult Dipnoi, and some ganoids, a double respiration, aerial and aquatic. The facts which go to prove that we have in this case to deal with aquatic respiration are, 1°. Rhythmical movements of the hyoid apparatus, by means of which water is forced in and out of the pharyngeal cavity, thus insuring a constant flow of water over the pharyngeal mucosa. 2°. The habit these turtles have of remaining under water from two to ten hours voluntarily, and their ability to endure a submersion of fifteen hours in running water without apparent inconvenience. 3°. The structure of the lining membrane of the pharynx with the copious blood-supply. The surface of the mucosa is prolonged into simple and compound papillae of various shapes and sizes, many of them recalling the gill tufts of Necturus. The fourth and absolute proof of the aquatic respiration consists in the results of chemical analyses made by Professors Rich and Holton of Cornell university, who carefully tested the water in which a turtle had been immersed without access to air, and found a marked decrease in the amount of free oxygen in the water, and an increase in the quantity of carbon dioxide held in solution.

The following table shows the result of the analyses. In the first column is given the amount of oxygen in the quantity of water used in the experiment (1 kg). The second column contains the quantity of CO_2 which could be made from this O. The third column contains the actual amount of the CO_2 found in the water, the excess of which over the amount to be from the oxygen in water itself is given in the fourth column.

	O.	CO_2.	Actual CO_2.	Excess Co_2.
July 11,	71 mg.	$97\frac{3}{8}$ mg.	231 mg.	$133\frac{3}{8}$ mg.
Aug. 8,	32 "	44 "	$212\frac{7}{10}$ "	168.7 "
Aug. 9,	39 "	$55\frac{5}{8}$ "	168.7 "	$118\frac{3}{40}$ "

The excess of CO_2 in the water is accounted for by the presence of a certain quantity of O in the lungs of the animal at the moment of submersion, and by the intramolecular O of the tissues of the animal's body. An analysis of the contents of the lung revealed the total absence of O, and of CO_2 was found only a trace. The O is taken from the water by the papillate pharyngeal mucosa, the details of the structure of which lack of space forbids giving here.

Prof. C. E. Bessey read a paper on the inflorescence of Cuscuta glomerata. In his studies of this degraded morning-glory, the author has discovered that the dodder produces its flowers upon short, adventitious

branches, which themselves repeatedly branch, and are closely covered with scales. A further examination shows that this is the universal rule with the species, no normal inflorescence developing. The adventitious inflorescence always bears a definite relation to the position of the parasitic roots: that portion of the stem which produces roots, always produces flowers; and the greater the number of the former, the larger is the number of the latter. The stem proper dies away soon, not only between the inflorescence, but also in the flower-clusters themselves. The flowering branches establish direct structural connection with the host plant. When this is accomplished, the scales upon the branches often contain considerable quantities of chlorophyl.

A short paper by Prof. B. G. Wilder was read on the subject of the serrated appendages of Amia. The view held by Sagemehl and Ramsey Wright, that these organs are accessory respiratory organs, is found to be sustained by the experiment which Professor Wilder performed on the living animal; and his conclusions are, that, while the appendages have no function at the present day, it is quite probable that their development and paleontological history are well worth careful study.

Dr. C. S. Minot discussed the subject of the relation between histological differentiation and death, and arrived at the conclusion, that the only rational explanation of the fact that animals and plants undergo progressive decay, as well as a progressive development, is to be found in the fact that highly differentiated structures, or organs, have lost the plasticity of embryonic tissues, and are incapable of renewing themselves when once worn out: in consequence of this, death is the price paid by the higher organisms for their advanced organization.

In another paper, on the morphology of the supra renal capsules, Dr. Minot made an important addition to our knowledge of the structure of these still problematical organs. The structure of the capsule is similar throughout. There are masses and cords of cells which are in radial lines externally, but which are irregularly arranged internally. The cells of the medulla and cortex are almost identical in appearance in a six months' human foetus, on which account it is difficult to admit a double origin for the capsules. The same speaker presented a paper on a new membrane of the human skin, which he homologizes with the epitrichium of the lauropsida. It is situated outside the horny layer, and is entirely distinct from it: an extension covers both hairs and glands. It probably causes the vernix caseosa by retaining the sebaceous secretion.

An interesting and important paper on the embryology of Onoclea and other ferns was contributed by Mr. D. H. Campbell of Detroit, the details of which cannot be given here. Drs. D. E. Salmon and T. Smith of Washington, D.C., read a paper on a new chromogenous bacillus (Bacillus luteus suis). This form is non-pathogenic, and was found in the pericardial and peritoneal fluids in swine killed for the purpose of studying the swine fever. When grown in a meat infusion, the liquid becomes pale straw color, then orange with a greenish tint, soon changing to a wine red. The pigment when obtained pure is insoluble in alcohol or ether. An aqueous solution is decolorized by adding an excess of strong HNO_3, or HCl, but reappears on neutralizing with potassium hydrate, or ammonia.

The relation of ovary and perianth in the development of dicotyledons was discussed by Prof. J. M. Coulter. A most simple and important character of systematic value was discovered in the study of the embryology of the dandelion; and, on comparing with the same embryonic stages of a large number of families, it was found that the character of superior or inferior ovary was the first recognized. In the case of an inferior ovary, the protuberance, which is to develop into the flower, is arrested in its axial development, grows perpendicularly into a collar (the nascent floral envelopes), and soon there appears an external constriction distinguishing the floral envelopes above from the ovary below. In the case of a superior ovary, the axial development is continued, and there is no external constriction. On such a basis the Compositae stand at the head of the list, then Umbelliferae, Rubiaceae, etc. The second group, that of a superior ovary, includes Leguminosae, Scrophulariaceae, Labiatae, etc. A paper on the structure and functions of the sphaeridia of the Echinoidea was read by Dr. Howard Ayers. The observations of Lovén were supplemented by a large number of structural facts, which, besides allowing of greater accuracy in determining the function of these peculiar organs, furnish an example of a highly specialized organ in this group that is comparable to the otolith sacs of Synapta. The following papers were read, of which extracts cannot be given here: 'The importance of individual facts of environment in the formation of groups of animals,' by Prof. J. B. Steere; 'On the morphology of the carapax and sternum of the decapod Crustacea,' by Dr. H. Ayers; 'Notes on some injurious fungi of California,' by Prof. W. G. Farlow; 'On the evolution of the lungs,' by Dr. C. S. Minot.

THE LIMITATIONS AND VALUE OF HISTOLOGICAL INVESTIGATION.[1]

While choosing a subject relating chiefly to microscopic structure for the address before the section of histology and microscopy, I wish first to discuss briefly what constitutes a complete knowledge of structure, and what are the limitations and value of this knowledge. The knowledge of structure depends greatly upon the coarser, i.e., the macroscopic relations. There is no magic in the microscope; it is simply a tool, nothing more. It is as illogical and hopeless to expect to understand the structure of an organ from what can be learned of it under the microscope alone, as for a geologist to expect to understand the topography of a continent by studying the sand of its sea-shore.

[1] Abstract of an address delivered before the section of microscopy and histology of the American association for the advancement of science, at Ann Arbor, Aug. 26, by Prof. S. H. Gage of Cornell University, vice-president of the section.

Microscopic anatomy should show: 1°. The nature and relations of the structural elements which combine to form any organ or tissue. 2°. The blood-supply. 3°. The lymph-supply. 4°. The nerve-supply, and relation of the nerves to the structural elements. 5°. The development of the structural elements, and their combination to form the various tissues. The structure of no tissue or part is known in all this detail. This is both encouraging and discouraging; for, while we see many problems unsolved, we know that they are problems which have eluded the grasp of the greatest anatomists of the world.

It is often said that a certain tissue must perform a given function on account of its structure; but we know that a moner or an amoeba performs all the life functions observed in the higher animals, and hence it seems hopeless to tell by structure alone what the function of individual cells composing one of the higher animals must be. Claude Bernard has said that structure is the key to the grosser and merely mechanical functions alone; and this is fully justified by the facts, that, before his work, the liver was thought to simply produce bile, and the pancreas to secrete saliva; yet the physiologist Bernard found the liver a manufactory of sugar, and the pancreas producing a juice with the powers of all the digestive ferments combined with the power of emulsifying fat. While, therefore, the most intimate structural knowledge gives no hint of the function of a tissue, it is of great value when the function is known in determining the significance of the structural relations.

Knowing the special differentiations accompanying a function, it is usually safe to assume that a similar structure will possess similar properties, and perform nearly the same function, no matter where found. Structural knowledge is also of great value to the morphologist, helping him to recognize and homologize the organs of different animals. Finally, without the knowledge of structure added to the knowledge of physiology, the splendid achievements of modern surgery would be impossible. While our structural knowledge is already great and valuable, our insight into the relations of structure to function is still very slight.

While specialization of function and differentiation of structure are concomitant, no one as yet can state the finer structural relations which accompany extreme specialization of function. It is not difficult to detect a nerve-fibre; but, from appearance, no one can yet say whether its function is associated with motion, sensation, or secretion: between these functions the gulf remains impassable.

Let me now call attention to the structure of an organ in the pharynx of the soft-shelled turtles, and briefly state my reasons for claiming that the mucous membrane of the pharynx is a *respiratory* organ. These turtles remain voluntarily from two to ten hours under water; and, while under, fill the pharynx with water, and expel it about sixteen times per minute: water so used has lost part of its free oxygen, and gained much carbon dioxide.

The pharyngeal mucosa is densely covered with minute cylindrical compound, or filamentous papillae, having the appearance of the villous coat of the intestinal mucosa. This membrane begins opposite the tongue's base, and extends to about opposite the third cervical vertebra, where it passes into the oesophageal mucosa, the beginning of which is surrounded by a sphincter, thus marking off the respiratory chamber. The epithelium of the mouth, pharynx and oesophagus consists of nonciliated nucleated cells, is many layered and stratified in the mouth, but gradually becomes columnar in the pharynx. The columnar cells are interspersed with small cells wedged into the spaces between their inner ends. Both kinds of cells send processes from their inner ends to help form the strong basement membrane. Sometimes the small cells are connected with the stellate cells of the deeper tissue by long processes. Beaker cells are found in the pharynx and oesophagus, but not in the strictly respiratory part. The blood-supply is copious, consisting of a capillary net work. A plexus of non-nucleated nerves gives off branches to the papillae, and probably terminate in the taste-buds (neuro-epithelia) found there.

Such is in brief the structure of this membrane. What is the special significance of this structure? Does it agree with other respiratory membranes? In the gill of a fish the blood-supply is abundant, as here; but the epithelium is tessellated, not columnar. In the external gills of the tadpole and newt, the structure is much the same, except that a columnar ciliated epithelium intervenes between blood-supply and the water. In the inner gill of the tadpole and external of Necturus a pavement epithelium is present. If compared with the lung membranes of air-breathers, there is a general agreement of structural facts; but the structure of each of these membranes stands out clearly from all the rest, that of the turtle resembling none so much as it does the villous membrane of the small intestine of a mammal. Yet the principal function of each of these membranes is the passing into the blood of oxygen, and the passing out from the blood of carbon dioxide. That these membranes vary widely as regards structure, while possessing identical functions, is but one more demonstration of the fact that, if we would have the whole truth, the study of structure and function must go hand in hand.

PROCEEDINGS OF THE SECTION OF HISTOLOGY AND MICROSCOPY.

WE have to record the cessation of section G, histology and microscopy, of the American association. This anomalous section, finding its end near, proceeded with dignity to request the association to kill it: the request has been granted, and we are consequently forced to write an obituary of an existence which we have long disapproved. Not that we are in any way opposed to microscopy, the most delightful of what-not sciences, but because microscopy had to be dignified by rob-

bing biology of its histology. To this the histologists have strenuously objected: the extreme of feeling was, perhaps, reached by one of these gentlemen, who declined the nomination to the presidency of the section on the ground that the establishment of the section was a disgrace to the association! However this may be exaggerated, it indicates the general sentiment among histologists, that their investigations are morphological or biological, and not 'microscopical.'

We have pointed out on previous occasions that microscopy does not constitute a natural division of science, but is a compound of fragments taken from many distinct sciences, and patched together by the arbitrary association with a single instrument. In the American association, the sections are distinguished according to natural lines of division in the domain of science, all except that of microscropy, which existed by encroachment on every one of its neighbors. Its trespasses will, we trust, now find posthumous forgiveness. On the other hand, there are many technical processes which are of interest to the majority of those who habitually use the microscope, but not to others; and these processes are essential to many investigations: it is to be hoped that Dr. Minot's suggestion, of forming a microscopical club within the association, will be carried out to insure the cultivation of technique among the members interested. In conclusion, we may mention another cause of the failure of section G; namely, the prosperity of the American society of microscopists, which has withdrawn many from the association who might otherwise have made the section successful. We fear that some of the microscopists may feel themselves to have been slighted; but surely such has not been the intention, for it must not be forgotten that the change was made at the request of the section itself.

The address of the president of the section was admirable. It was well received, and in itself the most valuable communication presented to the section. For the rest, the attendance was very small, and there were only four papers presented. In fact, the section exhibited too plainly its moribund condition.

Mr. W. H. Walmsley read a paper which will be of much value to photo-micrographers, as it gives exact directions for lantern-slides with gelatine plates. Mr. Walmsley described the methods which his own extended experience has led him to prefer, and added accounts of several manipulations and ingenious devices of his own. The utility of the paper is mainly practical. We have understood that it will appear in full in the proceedings.

Prof. T. J. Burrill reports that Dr. H. J. Detmers has obtained good photographs of Amphipleura pellucida by the use of a common coal-oil lamp. Still better results than with balsam preparations may be obtained with imbedding media of higher index. He says, further, "At my suggestion, Mr. S. W. Stratton designed and constructed a new heliostat of simple mechanism, which answers the purpose required in photo-micrography as well as the more elaborate and more expensive instruments, and which is far more readily managed. For those who need to have the sun's rays constantly thrown in any given direction for one day only without resetting, the apparatus is all that may be desired."

Mr. C. P. Hart described a clever manner of making a microscope into a microtome by using the tube to carry the imbedded object, and the movable stage to carry the razor; the object to be cut is moved by the fine adjustment.

THE NATIVE TRIBES OF ALASKA.[1]

The first half of Capt. Dall's address was devoted to the history of investigations into the anthropology of Alaska, which he divided into three periods. The first began with the expedition of Bering and Chirikoff, and continued during the remainder of the eighteenth century. The second began with the establishment of the Russian American company, and the third with the expedition of Mr. Robert Kennicott. The remainder of the address was taken up with an account of the native tribes of the region concerned, and closed with an attempt to classify the various tribes of the far north-west. We give almost without abbreviation that portion of the body of the address which deals with the Innuit.

Most of the Arctic Innuit are not separated into tribes in the same sense that the Indians of the United States, east of the Mississippi, were at the time of their discovery, nor even to the same extent as those Innuit south from Kotzebue Sound on the north-west coast. Terms are used to indicate the groups of Innuit geographically separated from each other by a stretch of unoccupied coast; and, for convenience, these terms are referred to as tribes. This is practically their own fashion. The people are all known as Innuit: those from a certain quarter have a special name, and those from each village in that district, or each river, have a still more special name. But there are no chiefs, no tribal relations in the strict sense; and the only distinction used among the people referred to is based on their locality of origin: they freely migrate from village to village, or district, and are not regarded as foreigners, though the obligation of free hospitality is not felt to be binding in regard to strangers from a distance long domiciled in another than their native village. We have no new information from the Kopagmut, nor from the people of the Colville River, except a few notes derived from the Point Barrow people by Prof.

[1] Abstract of an address delivered before the section of anthropology of the American association for the advancement of science, at Ann Arbor, Sept. 1, by Mr. W. H. Dall of Washington, vice-president of the section.

John Murdoch during his sojourn at Cape Smythe, as a member of Lieut. Ray's party, on duty at the International polar station known as Uglāāini. In the course of his admirable ethnological investigations he found that the Point Barrow people have the habit of using the plural rather than the collective form of the designation for a particular people, and call those of the Mackenzie River district by the term Kūpūng'-mi-ūn (Kopagmūt), and those of the Colville Kūng-mūd'-ling (Kūng-māligmūt).

For the people of Point Barrow, Mr. Murdoch and the other members of Lieut. Ray's party obtained rich ethnological data, which are in course of publication. Some interesting facts have also been gathered by Capt. Hooper of the U. S. revenue cutter Corwin during several visits to Point Barrow. As a whole, we shall soon be in possession of very full information in regard to this isolated band.

Of the Nūnātākmūt we have nothing since 1877; and of the Kū-āgmūt only a few facts collected by Lieut. J. C. Cautwell of the U. S. revenue marine, during his exploration of the river in 1884. He reports that the local name of the river is Kū-āk, not Kowak, as generally adopted on the charts. From Lieut. Stoney who followed him, and who has since returned to the region to carry on a more extensive exploration, a large addition to our knowledge of these Innuit may be expected in the near future.

Of the Innuit from Kotzebue Sound around to Norton Sound, little bearing on their classification or language has been gathered since 1877. The observations of Nordenskiöld and the Vega party at Port Clarence in 1879, and of the speaker in charge of the U. S. coast-survey party in 1880, at Port Clarence and the Diomedes, as well as Kotzebue Sound and the Asiatic coast near by; of Hooper in the Corwin, 1878–80; of the Jeannette expedition in 1879, — have added numerous facts, but little bearing on their distribution or classification which was not already known.

The most interesting people of the region adjacent to Bering Strait are the Asiatic dwellers on the coast, part of whom belong to the Korāk race, and part to the Orarian group of people. In no other ethnic group of the region has research been better rewarded since 1877. We have the admirable observations of the Vega party, the arduous explorations of Arthur and Aurel Krause, and some observations of my own, all of which, taken together, have done much to clear up one of the most knotty ethnological puzzles of the northern regions. I give the results in brief, as my time is not sufficient to go into details. The Asiatic coast presents us with the Tsaŭ-yŭ (plural Tsau-yŭat) or Tsau-chŭ, a people of Korak extraction, commonly known as sedentary Chukchi, who have lost their reindeer and settled upon the coast, adopting from their Innuit neighbors much of their peculiar culture, but not their language. These people bear about the same relation to the wandering or reindeer Chukchi that the fishing or farming Lapps do to the mountain Lapps of Lapland. Among them, with their little villages sometimes side by side, are to be found the Asiatic Innuit, who call themselves Yŭit (by local corruption of the race name), and who present essentially the features of the western Innuit of America, with some local differences. They migrate with the seasons from Cape Olintorsk to East Cape; their most northern permanent village, as far as known, is at the latter point. The Tsau-chŭ extend along the northern coast of Siberia much farther north and west. The two races are friendly; there is some intermingling of blood by marriage; and a jargon containing words of both dialects is used in communications between them. In my opinion, however, it is very necessary to keep in view that the culture of Tsau-chŭ, so far as it differs from that of the wandering Chukchi, is distinctly a derivative from that older culture of the Innuit race, though the arctic people of both hemispheres and all races have much in common, due to their environment. The word Chukchi has been so misused that it is almost meaningless; but, in the strict and accurate meaning of the word, there are no Chukchi on the American coast, as has been asserted. That error arose from the confusion between the Innuit and Yŭit on the one hand, and the Tsau-chŭ on the other.

Of the Innuit people on the American coast at Norton Sound and southward to the peninsula of Alaska, not much additional information has been made public since 1877 bearing on their classification. That in the report on Alaska, comprised in the publications of the U. S. census of 1880, is retrograde in many particulars rather than an advance, being the work of a person unqualified for the task. Magnificent collections bearing on the culture of these people have been made by Turner, E. W. Nelson, W. J. Fisher, C. H. Mackay, and others, and have been received by the U. S. national museum. But the unfortunate ill health of Mr. Nelson and other circumstances have delayed the publication of his rich and valuable observations. A good deal has also been done in the way of collections on the island of St. Lawrence by Hooper and Nelson, and in the Aleutian Islands by Turner, Dall, and others.

With regard to the tribal limits of the western Innuit, geographically considered, they are very mutable, and, especially in recent years, are constantly changing in small details. This arises from the fact, that the geographical group, which we have called a tribe among the Innuit, and for which in some cases they have a special designation, is not a political organization headed by a chief or chiefs, but simply a geographical aggregation of people who have by possession obtained certain *de facto* rights of hunting, fishing, etc., over a certain area. The jealousy of adjacent groups keeps the imaginary boundary-line pretty well defined through fear of reprisals should it be violated. When the whites came in with trade, and established posts all over the region, they also used their power to put down any conflicts, which are always injurious to trade. The boundaries, now violable with impunity, fall into oblivion, and the more energetic hunters and trappers go where they choose. In this manner the geographical group names I have described are ceasing to have any serious significance, and every new ethnographical visitor will find himself unable to make the ancient boundaries

correspond to the distribution of the moment. Nevertheless, in a general way, the old maps, such as that of 1877, still indicate the focus of the former group or tribe, and doubtless will long continue to do so. The Innuit tribes on the Kuskokwim have been found by Nelson to extend farther up the river than was supposed in 1877, reaching nearly or quite to Kolmakoff's trading-post. The advance up the Yukon, shown on the census map, is recent, if authentic. The St. Lawrence Island people are more nearly related to the Innuit of the American coast than to those of Asia, though their commerce is with the latter and with their Korak neighbors. As regards the Innuit of the region between the Koyukuk River and the Selawik River, the miscegenation indicated by the census map has no foundation in fact. The error doubtless arose from the permission accorded by the Innuit to special parties of Tinneh to come into and through the territory of the former for purposes of trade. The north shore of the peninsula east of Port Möller is represented by the census map as occupied by the Aleuts or Unŭngŭn. The region is really not inhabited, except for a few temporary hunting-stations, except by typical Innuit. Notwithstanding these and many other errors in this compilation, it is probably correct in extending the area of Tinneh about Selawik Lake, which is a useful addition to our knowledge. In 1880, while visiting Cook's Inlet, I was enabled to determine the essential identity of the native Innuit of Kenai with those of Prince William Sound, though among them were many Konia'gmŭt, brought there for purposes of trade in hunting the sea-otter.

With regard to the Aleuts, the degree of civilization to which they have attained is very promising. The people are not scattered over the archipelago except in their hunting-parties. In the western Aleutian Islands the only permanent villages are at Attu and Atka Islands. The division into groups is rather a matter of tradition than of actuality: practically they are as much one people as those of two adjacent English counties.

The easternmost of the Innuit people are the Chŭgăchigmŭt of Prince William Sound. At their eastern limit, there has long been a confusion, which I supposed I had cleared up in 1874, but which has only been finally regulated by information received from the brothers Krause, and obtained by myself in 1880. The census agent who visited them in 1881 was frightened by some boisterous demonstrations, and departed in the night in a small canoe, abandoning his equipage after a stay of some forty-eight hours. Consequently very little information was obtained by him, and that of an uncertain character.

Three stocks approximate to each other at this point, — the Chŭgăchigmŭt Innuit, the Tinneh of Copper River, and the Chilkaht tribe of Tlinkit. The latter have a precarious traffic coastwise, a few canoes annually reaching the Chilkaht village (sometimes called Chilkhaak) at Controller Bay by the dangerous voyage from Yakutat. But another path lies open to them, at least at times. One of Dr. Krause's Indian guides informed him that he had descended the Altsekh River (a branch of the Atna, or Copper River), which heads near the Chilkat River at the head of Lynn Canal, to a village of his own tribe at its mouth on the seacoast. Of the visits of the Ah-tenă tribe of the Tinneh I have had personal observation; and that the Chŭgăchigmŭt pass by them to the Kayak Island in summer, all authorities are agreed. This information explains the confusion of previous evidence, and shows why the vocabularies have sometimes afforded testimony in favor of one view, and sometimes of another. A jargon is probably in use in communications between the Tlinkit and the Innuit. That any ethnic intermingling of blood has taken place, I regard as too improbable to be worth consideration, having had personal evidence of the fear and hate existing between the two peoples. There is some distrust between the Tinneh and the Innuit, as elsewhere; but the bold and aggressive Tlinkit have committed so many outrages upon the timid and peaceable Chŭgăchigmŭt, that the feeling there is of a much more bitter character.

I have elsewhere stated my reasons for believing that the Innuit formerly extended much farther to the south and east. Nothing has since been discovered which materially affects the grounds of this belief of mine, and the subject is an interesting one for future investigation.

PROCEEDINGS OF THE SECTION OF ANTHROPOLOGY.

The meetings of this section were held with great regularity. The papers were all read on the days indicated, and were most of them of great interest and value, the hall assigned to the meetings being always filled with an interested audience.

The first paper, by Rev. Mr. Dorsey, gave an account of a visit to the Siletz agency. The author had spent several months at this agency, engaged chiefly in linguistic studies. The agency is located near the coast of Oregon, not far from the Columbia River. The Indians at the agency are all of them more or less civilized, and some of them take newspapers. In complexion they are lighter than most Indians, and are very short. The adult women, especially the older ones, have the face disfigured by tattooed lines. In many respects, both men and women resemble the Ainos. In their treatment of strangers, the Siletz Indians are very polite. The population of the agency is made up by the consolidation of over twenty tribes, none of whom are the original Siletz. Because of this, the language spoken is a jargon. The greater part of the paper consisted of a very methodical and scholarly account of the peculiarities of this language. A few only of the characteristics mentioned can be given. The verb varies with the position of the object. They cannot say 'that man,' but must say 'that man walking,' or sitting, or standing, etc. There are three sets of cardinal numbers, human, inhuman, and inanimate. Possessive endings are found in many words. All

their villages, of which two hundred and seventy have been located, have local names; as, 'the people of the ash-trees,' 'the people by the hill, 'the people of the cañon,' etc. A man must marry a woman from another village, and his children belong to the village of their father. They will not mention the names of the wild-cat, field-mouse, and some other animals before their children, lest they bring sickness and death upon them. Five is the mystic number among them. The paper closed with the Siletz myth of the creation. Following the paper were remarks by several members of the section. Attention was called to two popular errors concerning the Indians: one, that among them women are degraded, and mere slaves. Miss Fletcher and others showed very emphatically that women have great influence in the tribe; and, when married, they lose nothing of their identity, not even their names. Another error is, that the Indian is stolid, unemotional, and even sullen; whereas, in truth, he is impulsive, fond of a joke, and keen to appreciate it; sympathetic, and grateful for any kindness shown him. One speaker mentioned some of the customs of the Pawnees, who were divided into four clans or groups; and these were so distinct from each other, that formerly the members of different clans scarcely knew each other, and they married only within their own group.

Next came a paper by Rev. W. M. Beauchamp, on the permanence of early Iroquois clans and sachemships. The speaker showed that many of the institutions of the tribes forming the Iroquois league were far from being so unchangeable as had been supposed. He believed that historical evidence showed that the famous league was itself formed gradually, and not very long before the advent of the whites; and he showed, that, in the time of Champlain and other early explorers, it was only a loose confederation. The use of wampum is not of very remote antiquity, and had been known for no long time when the country was discovered. Changes had occurred both in the number of sachems and in the mode of electing them. Although the general rule, that the chieftainship was not hereditary in the line of the father, was usually followed, there were exceptions, — the son succeeding his father in office, and, in at least one case, his son following him.

Mr. A. W. Butler then read a paper on the remains at San Juan Teotihuacan. These ruins are about twenty-seven miles from the city of Mexico, near a small station on the new railway. After proceeding a short distance from the station, the ground is covered with obsidian flakes, spear-points, knives, bits of pottery, heads and figures of pottery; while here and there appear ruins of houses, with the walls decorated in figures of bright red and yellow. The chief ruins appear first as huge masses covered with bushes and other vegetation. Only upon close examination does the pyramidal form appear. The first and largest pyramid is called 'the house of the sun.' Its base is 682 feet long and a little less in width, while its height is 221 feet. About the base are numerous small mounds; and on the eastern side is a path, which, in zigzag-fashion, passes to the top. In this path are what appear to be steps made of volcanic rock fixed in cement. From the top a great number of ruins may be seen in every direction. On the top are several larger stones than any about the pyramid; and it may be that these are what is left of the temple of the sun, which, according to early writers, stood there. North-west from this pyramid, and distant about a thousand yards, is a smaller pyramid, 'the house of the moon.' The rectangular base of this is 511 feet long and 426 wide, and the height is 137 feet. Both pyramids are truncated at the summit, and built in three terraces, each terrace receding six feet from that below. Each of the three terraces was built by itself, and made of earth covered with a coating of cement, varying in thickness from three to six inches; and finally, when the full height was reached, another coating of cement was spread over the whole. Imbedded in this outer layer are numerous fragments of volcanic rock. The author described the profusion of objects of obsidian and earthenware which were strewn over the ground about the pyramids, and urged a speedy and diligent study of the region by competent archeologists. In the discussion following the paper, the pyramids named were compared with that of Cholula, and some of the points of difference were mentioned. The pyramid of Cholula is a mass of earth like those described in the paper; but, while these are covered with cement, that is built up on the outside with adobe brick.

Following this paper was one on the significance of flora to the Iroquois, by Mrs. E. A. Smith. The paper was a study of the names given to various trees and plants in the different nations of the Iroquois, and a comparison of these names, thus tracing them up to the parent stock.

Prof. N. H. Winchell exhibited a sheet of what he believed to be an alloy of copper and silver, as very careful analysis and examination showed it to be. The author first showed that no such alloy was known as a natural product, and that hitherto nothing like it had been found among the remains of the aborigines. The sheet was about half an inch thick, of triangular shape, partly rolled up, and weighs eight pounds. It was found near Temperance River, Minn. In the remarks which followed this paper, Mr. F. W. Putnam said that he believed that all the copper objects found in the United States were made of beaten copper not cast. He also described certain ornaments made of silver and copper beaten together; but none of alloy were ever found in North America, although in South America silver and copper alloyed to form bronze had been found.

On Friday morning the opening paper was by Miss A. C. Fletcher, on the sacred war-tent, and some war customs of the Omahas. Like all of Miss Fletcher's papers, this was a very clear, minute, and valuable account, and was received by the section as a most welcome contribution. The sacred tent is used for the storing of the sacred objects of the tribe, such as are used in its rituals and ceremonies. These objects were held in great reverence, and most sedulously

guarded. The tent has a special keeper, whose business is to care for it and its contents. These contents consisted of the sacred shell, which is a large river shell or Unio. This shell is contained in several leather pouches, one within the other; and in the shell itself are placed strips of the inner bark of the cedar, and a scalp. In the tent are also the sacred wolf-skin, and two bundles covered with tanned skins. One of these bundles is somewhat like a duck in form, and contains sundry bird-skins; the other is box-like in shape, and no one now living knows its contents, except that it contains various deadly poisons. There are also a staff of cedar and one of iron-wood, a small pipe-stem, two war-pipes, tobacco, and a scalp, obtained by warriors who had obtained the wolf-skin. All of these objects, which for generations had been kept and cherished by the Omahas as their most precious possession, have been given over to the care of the Peabody museum of archaeology by their keeper, with the consent of the other chiefs. This action is most important; since it marks the determination of the tribe to leave forever the usages of their fathers, and to continue in those of civilization which they have already adopted. The use and significance of some of the sacred articles were described. The sacred shell must never touch the ground; as, if it did, a devouring fire would come from it, which would destroy vegetation, and even streams and springs. To prevent this, the shell in its pouches is hung up in the tent; and when the tribe is on the march, the shell is carried by a boy especially chosen for the purpose. This boy slings the pouch over his shoulder, and is provided with a pointed staff to assist him should he stumble. If the boy wishes to play, he may thrust his staff in the ground, and hang the shell upon it. No one, except the keeper, may even touch the sacred objects: if he does, grievous sores will come upon him. Although, if one has accidentally touched them, he may be allowed to go through certain ablutions, assisted by the keeper, until he is purified; and then the evil is averted. If an enemy is supposed to be prowling about, and it is thought best to send out scouts, they are prepared by certain ceremonies. The sacred pipes are filled and offered to them; and they are solemnly admonished to report on their return only the exact truth, and to be careful to observe well. It is regarded as a very great honor to be chosen to act as scout. The poisons contained in the box-like bundle are used in various ways. One use is in punishing a mischief-maker, or incorrigibly troublesome member of the tribe. A staff is poisoned, and given to a discreet young man, who goes at night to where the offender's ponies are, and pushes his stick against them one by one, breaking the skin, so that the poison may get into the blood; and before morning all the ponies poisoned will be dead. The severity of the punishment determines the number of ponies so destroyed. There are ten distinct honors which may be obtained from the killing of an enemy; and they may be indicated by eagle's feathers, or other ornament. These honors are, one may kill an enemy, four may strike him, four may take his scalp, and one may cut off his head. The degree of danger involved in an exploit affects the honor received from it; e.g., to strike an enemy is a greater honor than to shoot him from a distance. The speaker called attention to the fact, that Indians were very fond of deceiving the whites in their dress, putting on wholly incongruous things merely for effect or sport, and arraying themselves as they would never do when wearing only what they had a right to wear. On this account, many of Catlin's pictures are incorrect, and many of the costumes worn by the delegations to Washington are not such as the wearers would ever assume at home. A curious custom exists among the Omahas. When a warrior is recounting his deeds before the tribe, he holds a short stick in his hand over a small pack in which is a hole. When so ordered, the boasting one must unclose his hand, and let the stick drop; and if it rolls into the hole, he has told the truth; but if it rolls off, as it is very likely to do, he has at least made a mistake. When on the war-path, Indians are trained, as one expressed it, 'to walk as one dead;' that is, to be wholly indifferent and insensible to all bodily discomforts and dangers. The war-party consists of warriors and servants. The servants are usually young men, and it is for their interest to act as such; for, in this way, they accompany the war-party, and, if a conflict takes place, they are allowed to hide their kettles and camp-equipage, and to engage in the battle; and, if one strikes one of the enemy, he is promoted to the rank of warrior. The dress of the warrior is simple, and over all is thrown a buffalo-robe worn with the hair inside. This is tied by leather strings; and day and night it must be worn, and the strings not untied until the enemy is met, or else the war-path abandoned.

Mr. F. La Flesche read a paper on the laws and terms of relationship of the Omahas. This was a paper of especial value, in that it afforded the section an opportunity of hearing, not from one who had gathered his information from strangers, but from one who had received it from his parents, and grown up among the customs described, and who spoke of his own people. Reference was made so constantly to a diagram, that is impossible to give any abstract of the paper that would be of much value. The singularly intricate, and to us absurd, system of relationship which has long been in use among the Omahas, was very clearly explained.

The next paper was by Mr. W. McAdams, on the exploration of recent Indian mounds in Dakota. The mounds in question were small burial mounds. Some of them, in one case a chain of four, were connected by a path of buffalo bones, which not only extended to the mounds, but directly over some of them. The bones were bleached very white, but there was no evidence of great antiquity anywhere. Aside from a small stone axe, only human bones were taken from the mounds opened. At the close of the paper, Mr. F. W. Putnam spoke of the conditions in which bones might be well preserved, and other conditions in which they would soon decay; and on this account the soundness or decay of bones was of little value in determining their age, unless the surroundings were well known.

In a paper on the burial customs of our aborigines, Mr. Henry Gillman exhibited two skulls, which had been perforated on top in one case by a single hole, and in the other by two. The holes were a little less than half an inch in diameter. The author regarded them as made soon after death, and perhaps as part of the burial ceremonies. Cremation prevailed over Michigan. Food was left for the dead. Sometimes the totem of the deceased was cut on a cedar board and placed at the head of the grave. In some cases the wigwam was consumed with the body. Mr. La Flesche said, remarking upon this paper, that among some tribes, if people died far from home, the body could not be transported; but the flesh and soft parts were removed, and then the bones could be carried back to the home for burial. Mr. F. W. Putnam spoke of the discovery of perforated skulls in Ohio. In one mound, there was a circle of sixteen skulls around two skeletons; and eight of these skulls were perforated, and all showed marks of scrapers used to clean them. On some of these were as many as ten holes.

'Ancient pictographs in Illinois and Missouri' was the subject of the next paper, by Mr. W. McAdams. Diagrams of figures carved on the walls of a cave in Missouri were exhibited; and also other figures found in a locality in Illinois, where there were painted figures of animals. Another diagram represented a composite monster, which was painted on a cliff near Alton, and remained intact until a few years ago.

Mr. W. L. Coffinberry exhibited some very fine specimens of stone, bone, and pottery collected in Michigan, after which Rev. J. W. Sanborn read a paper on the customs, language, and legends of the Senecas. He believed that the league of the Iroquois was much more ancient than some of those who had spoken before the section regarded it, and much more complex and wonderful. The Seneca language is complex: it contains no labials, nor do *r*, *q*, and *z* appear except in words introduced from the English; *h* is found either smooth or aspirate, and with very different meanings. There are five genders, three numbers, etc. The paper closed with a very remarkable myth, or legend, which one of the tribe had told the author. In the discussion which followed, evidence was given to show that the league could not have been formed so long ago as Mr. Sanborn thought; that probably there were no Iroquois in what is now New York before A.D. 1500, and probably not before 1550.

On Monday the first paper read was a long and elaborate discussion of music in speech, by Mr. M. L. Rouse. The paper was a comparative study of several prominent modern languages from the stand-point of the elocutionist and musician.

The next paper was on the stone axe in the Champlain valley, by Prof. G. H. Perkins. The author spoke of the different sorts of stone axe found in the region named; the relative abundance and elegance of the different forms; the variety found, both as to form, material, and finish; and exhibited some of the varieties mentioned. He called attention to the fact, that, while New-England stone implements have not usually been regarded as especially elegant or beautiful, yet some of the celts and other forms of the axe found near the shores of Lake Champlain are exceedingly fine; and in beauty of material, regularity of form, and smoothness of finish, some of them may be favorably compared with the best American or European specimens.

Rev. Mr. Dorsey read a very interesting account of Indian personal names, giving numerous examples, and in many cases showing how a name came to be chosen. He also gave some of the customs followed in giving names and in changing them. This change of name is not uncommon in the case of men, or even boys; but the women do not change their names.

A most delightful account of 'An average day in camp among the Sioux' was then given by Miss Fletcher. She described the taking-down of the tent preparatory to a journey, the leader's tent being first removed early in the day; then the catching the ponies for the saddle or wagon, packing the household goods, and setting out upon the march over prairies, through rivers, and on until about three in the afternoon, a suitable place being found by water and in a grove, the camp was set up again. In a most racy and vivid manner the common incidents of such a day were given, and with the zest which came from actual experience.

Several disks cut from human skulls, and worked into ornaments, were shown by Mr. F. W. Putnam. These were found in one of the Ohio mounds. They are several inches in diameter, and ornamented with incised figures. Marks of the scraper were visible upon them; showing that they were not cut from old skulls, but that they were taken from fresh subjects, and the flesh scraped from them.

A very carefully written paper upon the number-habit was read by Dr. C. S. Minot. The author referred to numerous experiments made under the auspices of the American society for psychical research, to determine, if possible, whether the so-called mind-reading had any basis in fact. In course of these experiments, numbers were used, one person thinking of a number, and another trying to guess what it was. On the doctrine of chances, the percentage of numbers rightly guessed should have been ten; but actually it was eighteen. The difference was explained by the author, by the fact that many persons formed what he called a number-habit; i.e., they were much more likely to think of some numbers than of others; and two persons having the same habit, would guess more frequently the numbers thought of than chance alone would account for. So far as the experiments of the American society went, they did not supply any reason for a belief in mind-reading; but the English society had obtained results that seemed to show that it was possible, so that judgment should for the present be reserved. Another paper by Dr. Minot was, "Are contemporary phantasms of the dead to be explained partly as folk lore?" This paper was a thoughtful and candid review of the ghost question, with the conclusion that popular beliefs and ideas, aided by imagination, were the basis of most, if not all, phantasms of the dead.

A verbal paper by Prof. G. H. Perkins, on certain strange stone implements from Vermont, consisted chiefly of general statements concerning Vermont archeology; and the exhibition of a considerable collection of peculiar implements, with remarks upon their character and rarity. The speaker mentioned the fact, that the evidences of a former occupation of the region, more extensive than has been supposed, were increasingly convincing; and also that two distinct layers, one much below the other, afforded relics.

A very excellent account of the Cahokia mound and its surroundings, with the results of his own extensive explorations, was given by Mr. W. McAdams; and many very striking resemblances to the Mexican pyramids were brought out. The writer showed by drawings and diagrams the forms and position of many mounds, which are found in the region of Cahokia in immense numbers. Mr. F. W. Putnam gave some very practical and detailed directions as to the proper exploration of mounds, pleading earnestly for thorough work in all explorations; and illustrated its value by several examples drawn from his own recent investigations. The last paper read was by Rev. Mr. Dorsey, who presented a most interesting collection of suggestive facts respecting primary classifiers in Dhegiha and cognate languages.

THE APPLICATION OF SCIENCE TO THE PRODUCTION AND CONSUMPTION OF FOOD.[1]

Mr. Atkinson, in his opening remarks, said that he presumed the business of the association was not to popularize science by lowering its standard, but to bring the progress of science and art in their application to human welfare prominently before the public. While giving full credit to those who engage in the pursuit of knowledge for its own sake, yet Mr. Atkinson would believe that their work must finally rest for its justification upon its influence on the material welfare of the race. To this end the address was devoted to the future applications of science to the production and transportation of food. In preparing the address, the speaker endeavored to bring into clear view the vast changes, both social and scientific, which have rendered the production and distribution of all commodities, especially of food, so much easier and more equitable during the present generation than ever before, and, to some extent, to show what further progress might be immediately before us. He endeavored to demonstrate, that, in the generation which will have passed between the end of our civil war to the beginning of the next century, greater progress will have been made in the way of material welfare than in any preceding period of the same length.

It is commonly assumed that the invention of the steam-engine, spinning-frame, and power-loom made greater changes in the production and distribution of wealth in a single half-century than have ever occurred before or since; but it will be observed that the forces of steam were limited during the first half of the century to reducing the cost of labor in making textile fabrics and in working mills. It is only in recent years that it has exercised any great influence on the production or distribution of food. However important clothing may be, it is relatively unimportant as compared to food in the proportion of labor required for its production.

All the available statistics prove that to the working people of this country the cost of food measured in money, including drink for whatever it is worth, is not less than three times the cost of clothing; and the proportion is even greater for the working people of Europe. How much greater this disparity must have been twenty-five years since, when the value of grain was exhausted by transportation over a hundred and fifty miles of common highway! If, then, one-half the struggle for life, measured in money, and more than one-half when measured by the work of the household of the prosperous mechanic, is the price paid for food, it is evident that the inventions and improvements of the last twenty years, which have been mainly directed to the increased production and cheap distribution of grain and meat, have affected human welfare in even greater measure than the inventions of the last century.

After referring to the advantages to the commerce of the United States, owing to the vast area over which free competition is possible, Mr. Atkinson enumerated various changes which have been brought about by the application of more scientific methods in machinery, and by the discoveries in the last twenty-five years: he referred to the displacement of the paddle-wheel by the screw-propeller; to the perfection of the compound steam-engine; to the discovery of oil-wells; and to the growing use made of electricity.

To this picture of prosperity, there is another side: vast progress has been made in individual wealth and common welfare; the time necessary to be devoted to the struggle for life has been reduced. But, great as our progress has been, and huge as our abundance now appears to be, yet the fact remains that the average product to each person in this most prosperous country, measured in money at the point of final distribution for final consumption, does not exceed fifty to fifty-five cents per capita per day; and our whole accumulated wealth, aside from land, does not exceed two, or, at the utmost, three years' production. After we have provided for the support of the government, for taxation, each average person must find shelter, and be supplied with food and clothing out of what forty to forty-five cents will buy. Moreover, whenever any great invention displaces common laborers whose development has not been of such a kind as to fit them for other work, they suffer for the time. The Yankee boy of former days, who attended the common school for three or six months in the year, and during the rest of the year was a jack-at-all-trades, was thereby enabled to

[1] Abstract of an address delivered before the section of economic science of the American association for the advancement of science, at Ann Arbor, Aug. 26, by Edward Atkinson, Esq., of Boston, vice-president of the section.

a master of any trade which he might after-
hoose. Such is not the case at present. From
sus of 1880 it appears that out of every thou-
ersons engaged in gainful occupation, three
l and twelve were classed as common labor-
This proportion was doubtless increased be-
1880 and 1882 by immigration, and it is this
hich suffered from diminished railroad-build-
ing the last three years. The true remedy can
ist in the development of versatility and man-
cterity, and of capacity on the part of the
child in the community to take advantage of
ortunities which may offer.

respect to the applications of science, crude
are in respect to agriculture, they assure an
nce for any increased population during the
century. With respect to the mechanism of
ition, the cost has been reduced so that there
margin for further saving. In the conversion
e materials into forms ready for consumption,
ld for improvement is still a broad one. In
ale traffic, as well as in retail distribution, of
ble commodities, there is a waste; and in the
of consumption, almost no progress has been

n recalling, however, that to common laborers
ood constitutes sixty per cent of the cost of
will be obvious, that, if we can show them how
ntain themselves in full vigor at the cost of
r forty per cent of their ordinary income, we
ave done good service. Prof. W. O. Atwater
dletown, Conn., has prepared a number of
in one of which it is shown, that, if we buy
in a sirloin of beef at twenty-five cents a
we pay one dollar a pound for it; whereas, if
k for protein in oatmeal or cornmeal, we pay
to fourteen cents for it. Mr. Atkinson praised
ir cheapness the Yankee dishes of fried fish-
nd pork and beans; and also the weekly ration
outhern negro, — a peck of meal, and three and
pounds of bacon; which, probably, supplies
eapest subsistence known. The rice of the
ay cost less in money, but is deficient in the
its necessary for full vigor.

le the American could live cheaply on oatmeal,
k and beans, yet he would not willingly do so,
uld wish for meat; and it is to the cheapening
cost of meat, rather than to the reduction of
sumption, that there is need of attention. Mr.
on referred to the partially abandoned lands
New-England States, as probably capable of
ing, if properly fertilized, beef at a cheaper
an is now done by cruder methods in Texas,
the cost of transportation to this market.

Atkinson based his scheme upon the claim of
rrish Furman of Georgia, that he is able to
wo and a half bales of cotton to the acre on
oned cotton lands when suitably fertilized with
rt potash, and the phosphate rocks of South
a. He would bring the cotton-seed meal to
husetts, there feeding it, and thus converting
nerals into fertilizing elements to be used on
ren lands of New England to raise Indian corn,
which should be used as pitted fodder or ensilage for the cattle. If this proposition can be sustained, it may happen that when the population of the United States of 1880 shall have doubled, an area of land no larger than that needed in 1880 will be required to sustain the people of that day.

At the close of his address, Mr. Atkinson presented a number of statistical tables showing the cost of life of various classes of people, mostly operatives or mechanics, and some tables showing the cost of maintaining inmates of public institutions. The investigation of the statistics does not increase Mr. Atkinson's faith in the law of population propounded by Malthus, or Ricardo's theory of rent, or the so-called law of diminished returns from land.

PROCEEDINGS OF THE SECTION OF ECONOMIC SCIENCE AND STATISTICS.

THE opening paper in this section was by Mr. Henry E. Alvord of Houghton Farm, New York, upon the relative values of human foods, and had especial interest, as forming in a degree a continuation of some of the interesting considerations contained in Mr. Atkinson's vice-presidential address. The author's comparisons of different articles of human food were based upon their average chemical composition alone, it being his belief that "we are so much in the dark on the questions of the actual proportions of digestibility in different forms of food, that it is safer to drop this factor than to include it."

Selecting as his basis of comparison for animal food, average ox-beef (flesh free from bone) at sixteen cents per pound, and for vegetable food, potatoes at one cent per pound, and rating animal fat at twelve cents per pound, and the carbohydrates of vegetables at four cents per pound, he arrived at the following money values, per pound, for the three classes of nutrients: —

	Protein.	Fat.	Carbohydrates.
Animal	72 cents	12 cents	7 cents.
Vegetable	10 "	7 "	4 "

Based upon these valuations, elaborate tables were presented, showing the nutritive value expressed in money, of all important articles of human food in comparison with their cost. The investigation was undertaken with particular reference to the food value of dairy products, and the results show that skim-milk, butter-milk, and cheese, at usual retail prices, furnish a given amount of nutriment more cheaply than any other articles on the list, being approached in this respect only by fresh mackerel and dried cod-fish. Milk, on this scale, sells for about its nutritive value; while butter costs two or three times its real food value, and often more. "What shall be said," continued the speaker, "of domestic economy in America, where more butter and less cheese are consumed per capita than in any other nation in our zone? And what of the government of some of our great cities, where boards of health absolutely prohibit the sale of skimmed milk, and actually destroy all that can be found?"

Of meats, pork and mutton are the cheapest, and veal the dearest. Of fish, mackerel is cheapest. Eggs generally sell at their full food value. Wheat-flour, oat-meal, and beans are the cheapest forms of vegetable food.

In the ensuing discussion, attention was called by several speakers, including the author of the paper, to the fact that chemistry alone cannot measure the nutritive value of the food, and to the great importance of those nervous and other influences which play such an important part in nutrition. Some very interesting statements were also made by the president of the section, regarding the dietaries of the working-classes and their cost.

Next followed a paper by Dr. C. V. Riley, upon the probability of injury by locusts (grasshoppers) in the immediate future. A certain periodicity has undoubtedly been established in the visitations of these insects, a period of about eleven years, on the average, elapsing between the times of serious damage. At present, considerable apprehension exists, based upon knowledge of somewhat serious injury by locusts, in California, Montana, and Dakota. A large part of this damage has been done by local (non-migratory) species; but the migratory species are also rather numerous, and we are probably at the beginning of a period of increase. To what extent this increase may go, depends considerably upon the climatic conditions during the present summer and autumn: but it is probable, that, even in the most unfavorable case, the damage will never reach the proportions which it did in 1873–77; for the advance of civilization since that time will prevent the massing of the insects in such enormous bodies as was then possible.

This paper was followed by another, by the same author, upon a new method of destroying locusts by the use of poison-bait composed of bran, sugar, arsenic, and water, which has been used successfully in California, and promises to be valuable in some cases.

The afternoon session was opened by a paper from Mr. C. Reemelin, upon city government. After a lengthy historical review of the history of city governments, its failures and mistakes, the question of remedies was taken up. These must be chiefly sought in constitutional reform. Of special suggestions may be mentioned, the strengthening of the executive power, and its committal to one responsible head; supervision of city expenditures by state authority; a state city council of from four to ten delegates from each state, for consultation upon common interests; and reform in municipal taxation. In the discussion which followed, special stress was laid upon the fact, that in a democracy good government depends ultimately upon the individual citizen; and Mr. Reemelin's paper was criticised as leaning too much towards purely legislative remedies.

Following this, a paper was read by the president of the section, Mr. Edward Atkinson, upon insurance against loss by fire. In all systems of fire-insurance, the losses are paid from the premiums; that is, by the assured. Consequently, while at first sight it may not seem to be to the interest of the assured to take special precautions against loss by fire, it really is so; since the greater the risk of loss, the greater the premium he must pay. The speaker described the workings of an insurance company of which he is president, which aims to prevent loss by fire by a system of inspection. The system is applicable only to large manufacturing and like establishments where strict care and rigid inspection are possible. Before insuring, the owner is required to conform to certain requirements regarding construction of buildings, provision of fire-apparatus, etc. After he is insured, regular periodic inspection by the experts of the company is made, and any dangerous conditions must be remedied. In case of persistent refusal to comply with the recommendations of the company, the policy is cancelled. About the usual rate of premium is charged; and the excess of premiums over losses, amounting to a considerable proportion, is returned to the policy-holders. The interest upon the premiums paid in has nearly paid the running expenses of the company; and the saving in cost of insurance during the last thirty years, at five per cent compound interest, equals the total combustible value of the property insured.

An interesting discussion followed upon methods of construction of slow-burning buildings, automatic appliances for extinguishing fires, etc.

The morning session of Aug. 28 was opened by an exercise illustrating a method of teaching elementary science in grammar schools by Mrs. Ellen H. Richards of Boston. The method is designed to lead children to observe and think for themselves, and was very successfully illustrated with a class of children from the Ann-Arbor schools.

Following this was a paper on the present status and future prospects of silk-culture in the United States, by Dr. C. V. Riley. Silk-culture has been practised in this country for half a century; but the industry is far from being established, these trials having only shown that silk can be raised over three-fourths of the United States if there is a market for the cocoons. At present this is largely lacking, all attempts to manufacture so-called 'raw' (reeled) silk in this country having proved financial failures. The writer advocated a protective duty upon 'raw' silk to encourage the production of cocoons in the United States. The raising of silk he holds to be an industry best carried on as a domestic industry on a small scale, and as adapted especially for the many women and children who cannot readily find any other productive employment. The profits he estimates at $15 to $25 for the season for a family of three persons with cocoons at $1 per pound.

In the discussion of the paper some of Dr. Riley's conclusions were questioned by Mr. Atkinson, who maintained that the establishment of silk-culture in the United States is not desirable. There is no lack of employment for labor in the United States, as the high rate of wages shows; and the fact that the making of reeled silk has been unprofitable, shows that capital can be better employed. Silk-culture is a handicraft simply, and has always been carried on by

the poorest and most inefficient peoples, who, as they rise in the scale, abandon it, as is now coming to be the case in southern France. The argument, that we shall save the $20,000,000 which we now pay for imported silk, is fallacious. When we exchange articles produced by labor costing $1 per day, for the silk of China or Japan raised by labor costing five or ten cents per day, we gain and not lose. We cannot afford to do for ourselves what foreign paupers will do for us cheaper. A power-loom for weaving silk has probably been invented in the United States; and when this is perfected, we may buy raw silk, and manufacture it here at a profit.

The afternoon session was opened by a long and interesting paper by Gov. John W. Hoyt of Wyoming, on the need of a systematic reorganization of the executive departments of the government in the interest of science and of public economy. After describing the gradual growth of these departments, and pointing out forcibly the many incongruities and disadvantages of their present organization, and the need of a reorganization, the writer proceeded to describe his plan, which he supported with powerful arguments. It is in brief outline as follows: First, the transfer of the bureau of Indian affairs to the war department, and the separation from the interior department of various technical and scientific bureaus. Second, the separation from the treasury department of similar bureaus not properly belonging to it. Third, the expansion of the department of agriculture into a real department of industry and commerce, presided over by a cabinet officer. Fourth, the expansion of the post-office department into a department of post-offices and telegraphs. Fifth, the erection of a department of science under a cabinet officer, to include the bureau of education, the government-surveys, the signal-service, the naval observatory, the national museum, the library, a bureau of charities, the charge of government scientific expeditions, an advisory superintendence of public works, and, in short, all the scientific work of the government.

An interesting discussion followed, turning largely upon the fundamental points of the legal right of the government to undertake scientific work, and the desirability of its so doing.

The president of the section next presented a paper entitled 'Competition and coöperation synonymous terms,' in which he maintained that the final result of competition is to better the condition of the laborer, and to improve the quality of the product. Like the forces of nature, it produces occasional great disasters, but produces its beneficent results silently and unnoticed. The competition of laborer with laborer is occasional; that of capital with capital constant, and to the advantage of labor. Since the beginning of this century, working-people have been receiving an increasing share of an increasing product.

The day's session was concluded by a paper by Mr. Charles W. Smiley upon some defects of our savings-bank system, and the need of postal savings banks in the United States, in which the writer presented the well-known arguments in favor of postal savings banks, some of which were rather severely handled in the ensuing discussion.

The short morning session on Monday was occupied with a paper by Dr. G. W. Hubbard of Nashville, Tenn., on vital statistics of the colored people of the southern states. The death-rate among the negroes in the cities and large towns is much greater than among the whites; while, so far as the confessedly imperfect statistics show, the birth-rate is not greatly different. The writer instanced the three cities, Chattanooga, Memphis, and Nashville. In the latter, very carefully kept statistics for the past ten years give an annual death-rate per 1,000 of from 17 to 26 for the whites, and of from 27 to 50 for the blacks. The other two cities showed nearly the same proportion. The birth-rate in Nashville, according to official statistics, was in the proportion of 1 white to 2 colored in 1881 and 1882, as 1 to 1 in 1883, and as 1 to a trifle over 1 in 1884. These figures, however, the author put but little confidence in. The causes of the greater mortality among the negroes the author classed under the three heads of ignorance, poverty and its attendant evils, and race characteristics. He considers that the condition of the negroes is gradually improving in the first two particulars. In regard to the prospects of an amalgamation between whites and blacks, attention was called to the fact, that, in most of the southern states, intermarriage of the races is a criminal offence; and that the proportion of illegitimate births of mixed parentage is small and decreasing.

The afternoon session was opened by a paper from Hon. C. S. Hill, statistician of the U. S. department of state, upon the science of statistical analysis, giving some account of the collection and publication of statistics by means of the consular service of the United States, and emphasizing the need of the application of a scientific method to the interpretation of statistics. This was followed by a paper upon social economy, by Dr. John Müller, which closed the day's session.

In his paper upon the silver question, Mr. E. B. Elliott of Washington, D.C., after recounting briefly the history of silver money in the United States, and alluding to the danger which at present menaces the finances of the country, proceeded to enumerate briefly the remedies, which were: 1°, to coin no more legal-tender dollars, but only subsidiary coins; 2°, to increase the weight of these subsidiary coins from 12.5 to 15 grams per half dollar, and to stamp each coin with its weight and fineness; 3°, to base all statements, weight of bars, bullion, etc., on the metric system. An interesting discussion followed, in which Professor William Harkness pointed out most clearly the great gravity of the problem, and commended the recent action of the New-York banks in endeavoring to tide over the danger of the payment of silver by the U. S. treasury in its settlements through the New-York clearing-house. He also alluded to the great temptation to counterfeiting which the present law offers, and stated that it was pretty well ascertained that a considerable amount of it had been done. He closed with the statement that we had allowed ourselves to be made a cat's-paw to

relieve European nations, particularly Germany, of their excess of silver.

The closing paper was also by Professor Elliott, upon electric lighting, giving the results of an examination of the system in use in the Philadelphia post-office. The system is the Weston; the incandescent lights employing an electro-motive force of 73.75 volts, and the arc lights a current of 80.05 ampères. One effective horse-power of the engine was required for 13.25 incandescent lights, and for 1.43 arc lights. One horse-power on the incandescent circuit gave a light equal to 237 standard candles, and on the arc-light circuit of 1,077.3 candles. In remarking upon these results, a member called attention to the low electro-motive force employed, and pointed out that this largely increased the safety of the system as compared with others.

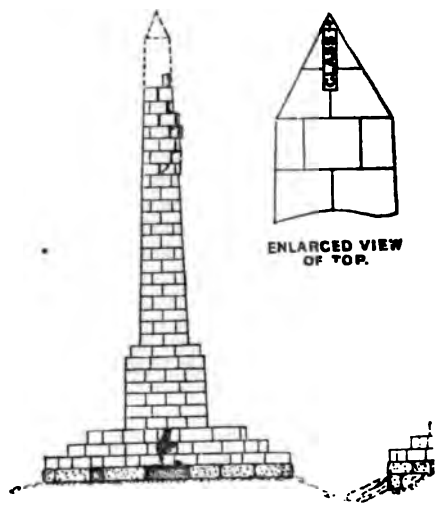
NOTES AND NEWS.

The officers elected for the next meeting of the American association for the advancement of science, which will be held in Buffalo, commencing Aug. 18, 1886, are: president, Prof. Edward S. Morse of Salem, Mass.; section **A**, mathematics and astronomy, vice-president, Prof. J. Willard Gibbs of Yale College, New Haven, Conn.; secretary, Mr. S. C. Chandler, jun., of the Harvard observatory, Cambridge, Mass.; **B**, physics, vice-president, Prof. C. F. Brackett of the College of New Jersey, Princeton, N.J.; secretary, Prof. H. S. Carhart of the North-western university, Evanston, Ill.; **C**, chemistry, vice-president, Dr. H. W. Wiley of the department of agriculture, Washington, D.C.; secretary, Professor William McMurtrie of the Illinois industrial university, Champaign, Ill.; **D**, mechanical science and engineering, vice-president, Mr. O. Chanute of Kansas City, Mo.; secretary, Mr. William Kent of Jersey City, N.J.; **E**, geology and geography, vice-president, Prof. T. C. Chamberlin of the U. S. geological survey, Beloit, Wis.; secretary, Prof. E. W. Claypole of Buchtel college, Akron, O.; **F**, biology, vice-president, Dr. Henry P. Bowditch of the Harvard medical school, Boston, Mass.; secretary, Mr. J. C. Arthur of the N.Y. experiment station, Geneva, N.Y.; **H**, anthropology, vice-president, Mr. Horatio Hale of Clinton, Ont.; secretary, Mr. A. W. Butler of Brookville, Ind.; **I**, economic science and statistics, vice-president, Mr. Joseph Cummings of Evanston, Ill.; secretary, Mr. H. E. Alvord of Houghton Farm, Mountainville, N.Y. No nominations were made for section **G**, histology and microscopy, as it has been decided to merge it in the biological section. The permanent secretary is Mr. F. W. Putnam of the Peabody museum, Cambridge, Mass.; the general secretary, Prof. S. G. Williams of Cornell university, Ithaca, N.Y.; the assistant secretary, Prof. W. H. Pettee of the University of Michigan, Ann Arbor; and the treasurer, Mr. William Lilly of Mauch Chunk, Penn.

— The Germans hold the fifty-eighth meeting of their association of naturalists and physicists this year at Strassburg, Sept. 17–23.

— The Anthropological congress, which is shortly to be held at Rome, will have a curious feature in a collection of 700 skulls of criminals, numbered and classified. To these, says *Nature*, will be added the photographs of 3,000, and the brains of more than 150 convicts; thousands of autographs, poems, sketches, and special instruments, the work of criminals; an album containing a record of 700 observations, physical and moral, on 500 criminals, and on 300 ordinary men. There will also be graphic maps of crime in Europe, with reference to meteorology, food, institutions, suicide, etc.; tables of the stature of criminals in relation to the length of the arms, and of crime in towns compared to that in the country. Mr. Bertillon will exhibit the graphic curves of 23,000 *recidivistes* examined in twelve parts of the body, and the practical results obtained. Photographs of Russian political and other criminals, especially of those from Moscow, and wax masks of a large number of celebrated criminals, will also be exhibited. All the notabilities in the science of criminal anthropology will take part in the congress.

— On the 28th of April, 1884, during a very severe thunder-storm, the monument of the first duke of Sutherland at Lilleshall, Shropshire, Eng., was struck and badly injured by lightning. Mr. C. C. Walker, who was near by during the storm, made a careful study of the monument and its surroundings, the results of which are published in the *Quarterly journal*



of the Royal meteorological society (January, 1885). The monument stands two hundred feet above the surrounding country, and is built of sandstone in the form of an obelisk. In 1839, six years after its erection, it was so severely damaged by lightning that it had to be taken down and rebuilt. The builder, ignorant of electrical science, fixed on the top, as the apex of the shaft, a pyramid of glass eight inches square at the base, and also inserted pieces of plate-glass six inches wide and thirty inches in length, in grooves cut in the sides of the shaft, thinking, so

at this, being a non-conductor, would pre-
petition of the accident of 1839. The acci-
ch occurred in 1884 completely destroyed
ten feet of the obelisk; and the next nine
f stone for about fifteen feet were all dis-
nd pushed out from the central axis, and
anger of falling. The platform was broken
ling stones, large stones on the circumfer-
e platform displaced, and some of the faces
es forced out altogether. The sod round
f the monument was ploughed up in fifteen
hree to six inches wide and ten to seventy
gth, while the grass was scorched brown.

Mr. Chandler proposes for future adoption — as the rounded tenth probably nearest the true value of the latitude of the dome of Harvard-college observatory, 42° 22′ 47.6″, in place of the value 48.3″ given in the *American ephemeris*, and 48.1″ given in the *Berlin jahrbuch* and the *Connaissance des temps*.

— In *La lumière électrique* for April 18, Mr. B. Marynovitch has a long article upon the telephone used as a signal instrument. The early part of the article is devoted largely to telephone calls, and to the telephone used as a railway signal. At the conclusion of the article, some attention is paid to the use of the telephone for military purposes; and we here

S. C. Chandler, jun., has published in the *ische nachrichten* a most interesting series ations, — made with his newly devised in- the almucantar, — to determine the latitude rd-college observatory. His results confirm hat the hitherto accepted value of the lati- ires a sensible correction. The new in- gives results remarkably accordant among s, the latitude deduced from a set of seventy- rvations being 42° 22′ 47.57″ ± 0.028″. Re-, in the light of more recent determinations r positions, the old observations made by s and Major Graham in 1844–45, and by the Cloverden observatory in 1855, and com- se with observations of his own in 1883–85,

reproduce one of the illustrations showing an officer seated in a casemate observing the effect of shot upon a target near by. He is supplied with a telephone, by means of which he transmits the results to the battery.

— We have received a papyrographed circular announcing the 'American economic association,' whose objects are stated to be the encouragement of economic research, the publication of economic monographs, the encouragement of perfect freedom in all economic discussion, and the establishment of a bureau of information. To this statement of the objects of the association is appended a proposed 'platform,' of which the first plank expresses ardent opposition to the doctrine of *laissez-faire*; the second

asserts the belief that political economy is still in the first stages of its scientific development, for the accomplishment of which it must rely chiefly on the study of statistics and history; the third holds that the host of social problems which have arisen through the conflict of labor and capital cannot be solved without 'the united efforts of church, state, and science;' and the fourth disclaims all partisanship in questions of governmental policy, and especially in that of free trade and protection. We understand that the meeting for organization was planned to be held this week at Saratoga, during the session of the American historical association just closed, and was to be of a private character, the participants being those who have been invited by the initiators of the movement. The association is designed to be of an academic rather than a popular character; and several college professors and others engaged in economic work have signified their intention to assist in its foundation.

— In the early part of 1884, Siemens brothers constructed an electric railway between Frankfort and Offenbach. The two rods conducting the current were suspended by insulators from poles; and from the top of the car, wires ran to these rods. The illustration which we reproduce from *La lumière électrique* for Jan. 24 shows the arrangement at a crossing. The length of the line was 6,555 metres, and there were employed upon it four cars: the tension was 600 volts, and the efficiency from 50 to 80 per cent, according to the position of the cars.

— The sixth international congress of Americanists, which was to have met during the present month at Turin, is postponed to September, 1886, on account of the ravages of cholera in Spain, which would deprive the congress of the presence of Spanish Americanists.

— The first part of anencyclopedic dictionary in Bengali, edited by two native scholars, has just been published in India. It contains descriptive derivations of Sanscrit and Bengali words, with Sutras quoted from Panini the grammarian; Arabic, Persian, and Hindi words introduced into the Bengali language; notes on the ancient and modern religious beliefs of India, the Vedas, Purans, Tantras, and other sacred books; besides short articles embracing the whole range of modern science.

— The Ohio state university has instituted a 'short course' in agriculture to obviate the objection sometimes made, that the full course of four years required more time than the young farmer could afford. The new course covers two years. For admission to the lowest grade of studies in this course, examination will be required in arithmetic, English grammar, and geography; but those wishing to enter the classes in algebra, geometry, or physics, must also pass an examination in algebra. The course of study includes agricultural chemistry, botany, agriculture, horticulture, veterinary science, mathematics, physiology, physics, physical geography, and 'mechanical laboratory.'

A short course in agriculture has also been instituted by the university of Wisconsin, in the hope of attracting those who can devote only a small amount of time or money to these studies. The course is a strictly technical one, consisting of courses of illustrated lectures upon agriculture, agricultural chemistry, agricultural botany, and veterinary science. It extends over the twelve weeks of the winter term, and is designed to be very elementary and 'popular.'

— According to the latest returns of the English consul at Teheran, the population of Persia, which covers an area of 1,647,000 square kilometres, amounts to 7,653,000. Of 99 cities with a total population of 1,963,800 inhabitants, Teheran has 120,000; Tabris, 164,000; Ispahan, 70,000; Bushir, 60,000; Meshed, 60,000; Kerman, 71,000; Resht, 40,000; Jezd, 40,000; and Shiraz, Kirmashah, Hamadan, and Kashan, each 30,000.

SCIENCE.

RIDAY, SEPTEMBER 18, 1885.

IOULD BE SUPERINTENDENT OF NITED-STATES COAST-SURVEY.

ourse to be followed at Washington election of a superintendent of the ast-survey, will be watched with the concern by all who are interested in uct of that important bureau. Those y who believe in maintaining the civil n a high state of efficiency, and who the present administration for the pplication of sound principles in the of officials for positions of high re- lity, will form their opinion of the wis- l honesty of those in authority by the hich is about to be taken.

re informed that actually an appoint- s already been made; but we take it ted that it is only an appointment *ad* that the public service may not suf- letriment in the emergency which has In all probability, the officer now in of the survey, however qualified he to pronounce upon many of the ques- hich are brought to his notice, — and him spoken of in terms of great re- - would decline the responsibility of even for a few months, the work of a corps so numerous, so expert, and so as the surveyors and hydrographers of t.

ead of the survey must not only be nt to judge of results, as does the of the treasury, or the observing of congress, but he must be compe- point out the methods, and select the nd govern the various steps, by which red results are to be obtained. As esults — the accurate description of t, and the careful observation of the which are constantly in progress upon ne highways of travel and commerce

— depend upon the most precise physical measurements, and the most accurate mathematical discussions, the superintendent should be a man who has been trained in mathematical and physical science. Other qualities are also essential, but they can be found in men who have been trained to this particular kind of scientific work.

If there should be a vacancy in the supreme court, none but a lawyer would be thought of for the position; if there should be need of a surgeon-general for the army or the navy, none but a physician would be appointed; only a military engineer would be competent to conduct the military engineering of the government. What is true of the older professions is true of the newer. The director of the coast and geodetic surveys of this vast country should be one who will command the professional confidence and respect of all who are themselves expert in hydrography and geodesy. He must be surveyor-in-chief, or surveyor-general. He should have high personal character, acquaintance with the structure and physics of the globe, skill in adminstration, and the power of complete and lifelong devotion to a work of great responsibility and honor.

It is not necessary to look for such a man in the army or in the navy. Indeed, there are grave objections to detailing any officer of either arm of the service to the conduct of the coast-survey; and it may be assumed, that no one will resign from the army or navy to enter upon the unpensioned and uncertain career of a civilian. Fortunately, there are several men in civil life whose pursuits and attainments qualify them for the superintendency, — men who have already won distinction in mathematical and physical researches. Among them are men of excellent business habits, of administrative skill, of honest, faithful, and industrious lives. Upon such a man we sincerely hope the choice will fall.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The study of logic in the scientific schools.

THAT logic should be thoroughly studied in our scientific schools is a thesis which we support most strenuously, but, so far as we know, without the indorsement of any of the faculties of those schools. At all events, such courses of study in scientific schools as have come to our notice, make no provision whatsoever for the study of logical science.

The reason for this is, perhaps, indifference on the part of the faculties; but we think it more likely to be the crowded condition of the scientific curriculum. That the last mentioned is a legitimate excuse, may be seen from the fact that our scientific schools are continually raising the standard of the entrance examinations, so putting as much work as possible into the preparatory years. A glance at the catalogue of any first-class institution will show this, as well as that the four years of the course are even now fully occupied. In the School of mines of Columbia college, for instance, a student of the second-year class must pursue fourteen or fifteen subjects; and five hours of attendance are the average number required of him each day. With the students of the third and fourth year classes the case is the same. Even if members of the first-year class had the time, they are too immature, and not sufficiently advanced, to gain the desired benefit from logical study.

Of course there can be no two opinions as to the feasibility of adding logic to such a curriculum as this. There is absolutely no time for it.

Our point is, that logic should have time made for it, and for two main reasons. First, because of its importance to the intellectual culture of the student; and, secondly, because of its importance to the value of any subsequent thought and investigation. As an intellectual gymnastic, logic, when properly apprehended and taught, is superior even to mathematics, and capable of far more general and varied application. The truth of this statement does not depend upon the dogma of any of the much-despised class of 'mediæval metaphysicians,' but numbers among its defenders men of the intellectual stamp of Jevons and John Stuart Mill.

But this is not the main support of our present argument. We prefer to lay more stress upon the second specification; namely, the great importance of a logical training for the value of any scientific work.

As a matter of course, we do not mean by logic any dry rattling of syllogistic bones, important as a knowledge of the syllogistic process and rules certainly is. But we have in mind such a treatment of the great philosophical organon as will introduce our scientific students to the elements of a theory of knowledge, teach them the nature and relations of the mental processes involved in a train of reasoning or proof, investigate with them the nature, limits, and canons of hypothesis and inductive inquiry, and discuss the nature of evidence, and the theories of proof and probability. All of these subjects should be familiar ground to every man of science, young or old. His work should be along the lines laid down by a correct logic, and his conclusions conformable to its canons. The logical writings of Herschel, Whewell, and Mill offer innumerable examples of the value of strictly logical processes applied to scientific investigation; and our common sense must assuredly emphasize their testimony.

The truth is that many an absurd deduction, many a false inference, would be avoided, were the investigator in possession of some knowledge of elementary logic. To say that men have reasoned and do reason correctly without logic, is no answer. So do children count marbles correctly while yet in ignorance of the rule for long division and the multiplication table. Not only does logic aid and clarify men's reasoning, and give it a defensible foundation to stand on, but it is the instrument for the detection and explanation of fallacies and false steps in scientific investigations by whomsoever they are made.

Other and cogent reasons for the acceptance of our thesis could be easily urged. But those just briefly stated seem to us sufficient at this time and place.

The instruction we plead for need not be elaborate. It need not be on the same scale as that desired by a specialist in mental science. A competent instructor could probably make two hours a week for a half-year suffice for what we have sketched above as desirable. And to secure the benefits that would arise from that instruction, we claim that any faculty in the land should gladly rearrange its course of study.

NICHOLAS MURRAY BUTLER.

Color and other associations.

In 1880, while I was in Washington, I read Mr. F. Galton's note on 'Visualized numerals,' in *Nature* of Jan. 15 of that year.

After I came to Madison, probably late in 1881, or early in 1882, I mentioned my own entire inability to visualize numerals, or any thing else of the kind, to a member of the university faculty, Professor O. I was interested to learn, that, when a boy, he had always conceived the vowel sounds as having color, and that he still retained some traces of this early habit.

I spoke of this subject at my dinner-table shortly after; and my daughter Mildred, then about eight years old, said she also had colors for the days of the week, as follows: Monday, *blue;* Tuesday, *pink;* Wednesday, *brown* or *gray;* Thursday, *brown* or *gray;* Friday, *white;* Saturday, *pure white;* Sunday, *black.* It was said laughingly; and at the time it passed to my mind as a joke — that she wished in sport to assume the idiosyncrasies of elder persons. A few days after, I questioned her on these colors; and she gave the same replies. It was again spoken of as a kind of joke and a question of memory, but I wrote the colors down in my memorandum-book for 1882. A year later I produced this, and again questioned her, this time seriously, and found her answers the same as at first. Again, Aug. 5, 1885, her replies were the same. The tenacity of a child's memory is very remarkable; but I was convinced this was not a case of memory and imagination, but a true phenomenon of the kind referred to. I therefore went farther, and asked her if there were any other phenomena of the same kind (she is now eleven and a half years old). I found that each of the letters of the alphabet had a color to her, as follows: —

A, white; B, blue; C, yellow, cream color; D, dark blue; E, red; F, black; G, green; H, white; I, black; J, gray, brown; K, gray; L, dark blue; M, N, brown, not much color; O, yellow; P, green; Q (?) R, brown; S, yellow; T, green; U, yellow; V, white; W, brown; X, Y, not much color; Z, greenish.

The prevalence of yellow and green, and the scarcity of reds and pinks, are noteworthy. I found she knew these colors instantly, and when I asked for them in any order. What is more remarkable, she can instantly name the brown letters in a group, the

nes, etc. Apparently she does not require to alphabet in review to decide this. The numo have colors to her, as follows: —
ck; 2, cream color; 3, light blue; 4, brown;
e; 6, crimson, pink; 7, greenish; 8, white;
ish (?) 10, brown; 11, black; 12, cream color;
; 14, brown; 15, white: that is, 11 has the
olor as 1, 12 as 2, 13 as 3, etc. These colors
named instantly, and in any order, and in

ther member of my family has this idiosyn-
A cousin, Miss S., staying with me, arranges
nths in an ellipse, in her mind. The major
the ellipse is conceived to be horizontal.
is at the left hand, October at the right, July
upper extremity of the minor axis, January
ower. The other months occupy equal spaces
n those already named. Hence it follows that
ngths are conceived as unequal. Half the
is occupied by the five months, October to
The direction of motion round the ellipse
ferent, left-right or right-left. This ellipse is
ed of as having absolute dimensions. The
axis is taken as about three and a quarter
In this connection I would refer to *Science*,
and Aug. 21.
e cases appear to me sufficiently noteworthy
rve this record in passing.

EDWARD S. HOLDEN.

Sept 7.

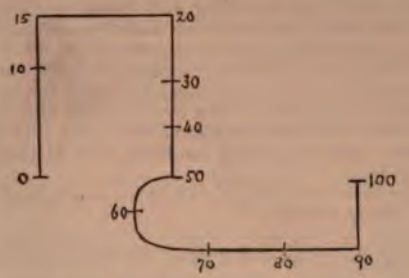
y mind, there has always been associated with
ame or word a color, or shade of color. With
ames the color is clear and well defined,
hers somewhat vague. I can only distinguish
light or dark. I give you a few instances:
mind, John, Jane, Ann, Mary, are red; Wil-
Valter, Robert, blue; George, Nathan, Gilbert,
Joseph, black; Mark, Judas, Humphrey,
James, yellow.
York, red; Chicago, light; St. Louis, reddish;
d, dark; San Francisco, yellowish; Leadville,
Denver, yellow; St. Paul, dark, etc. I never
ned this, excepting once or twice when a
d was laughed at as trying to say something
r.

GEO. S. MILLER.

Minn.

Ruheit's diagram of the months of the year
ired in his mind, and as represented in *Science*
. 21, is so strikingly similar to a conception of
, that I am led to present my diagram also.

similarity seems very remarkable to me. I
explain the *raison d'être* of the diagram.
s, as most boys go through about the same al-
ns of rest and work during their earlier years,
heit's explanation may apply here, and may
ount for the similarity of the diagrams.
gram of numbers which also forms itself in my mind, is of peculiar form, and is equally difficult to explain.



I cannot think of any number less than a hundred, that does not place itself immediately in its appropriate place in the diagram. ARTHUR WINSLOW.

Raleigh, N.C., Aug. 27.

The ginkgo-tree.

The paper on Salisburia adiantifolia, illustrating the 'phylogeny' of the genus Ginkgo, by Lester F. Ward, in *Science* for June 19, is one of great interest to botanists. In the Central Park we have a group of six trees in close proximity to each other, and which bear fruit abundantly. The group is composed of three males and three females, and for the past four years have borne an abundance of fruit. I herewith send you a photograph of a fruiting-branch, which will give an exact idea of how it appears.

E. B. SOUTHWICK,
Botanist and entomologist.

Department of public parks,
Central Park, New York, Aug. 28.

An abnormal black bass.

A black bass, weighing upwards of half a pound, was caught at Webster Lake, Franklin, N.H., Aug. 21, 1885, by Mr. Charles Aiken. The head of this fish presented a singular abnormality, which seemed worthy of a short notice.

The malformation was apparently restricted to the forehead and upper jaw. In other respects, the fish seemed to be normally developed, and in good condition.

The lower jaw was of proper size, and, when the mouth closed, protruded seven millimetres beyond its fellow, exposing the tongue for a length of three millimetres from its tip. This state of things gave the fish a very grotesque appearance, the 'nose' rising quite abruptly to the 'forehead' instead of making with it the customary straight line. The teeth of the lower jaw were entirely exposed, and, not meeting those of the superior maxillary, had become very numerous, and nearly twice their natural size, the exterior curving outward. The vomerine teeth, and those of the upper jaw which met the tongue, were about normal. The exposed parts of the mouth were unduly pigmented;

MICROPTERUS SALMOIDES (LAC.) GILL. MALFORMED.

[illegible]

F. H. [illegible]

The magnetic declination in 1722

[illegible]

I assume that there was a misprint of the figures in the original as given by the [illegible] and that the correct figure is 5° 30′ W. The magnetic [illegible] was taken from a [illegible] chart of the Coast and [illegible] Survey. It is stated in Dyer's [illegible] that the variation was taken [illegible] the year 1722. The magnetic [illegible] was taken from a

nce or taxation. He is not one of students who think that all social move- can be expressed in terms of arithme- He is as well aware as any one, that ctual forces are too recondite to be meas- y any calculus; but he knows the value nbers as well as their inadequacy, and used them accordingly in the study of sities with a master's skill.

refer to the recent work of Dr. J. Con- f Halle, translated by John Hutchison sgow, and introduced to English read- ences, so complete in its many-sidedness, and so helpful to those who wish to know the significance and the tendencies of advanced education in the nineteenth century, as that of the great economist of Halle.

Although it is not probable that the United States will ever have a system of universities exactly like that which Germany has established, the German experience will always be of the highest value to Americans. Our historical roots are in England; and our highest educational foundations are likely, hereafter as

MAP SHOWING THE DISTRIBUTION OF GERMAN UNIVERSITIES.

Professor Bryce of Oxford. The trans- rightly says of the original, that it is terized by "that thoroughness for which n research is proverbial," thus remind- of a remark of Matthew Arnold's, that, neral rule, "hardly any one amongst us, nows French and German well, would English book of reference when he could French or German one." We do not that it would be possible to produce in nd but Germany an educational memoir tworthy in its facts and in its infer- heretofore, to be developed according to non-Germanic methods. Nevertheless it would be deplorable if the leaders of progress in this land were indifferent to the wonderful influence which has been exerted upon modern society by the systems of research, of publication, and of instruction, brought by the Germans to such a high state of development. Foundations, the earliest of which came into being five hundred years ago, have shown new vigor within the last half-century, and were never so well worth study as now.

In every important institution of learning in this country, there are scholars who have felt the beneficent effects of German method in their own intellectual culture, who have been inspired by German enthusiasm and devotion, who have profited by German erudition and research, and who are endeavoring to hold up to Americans the example of German scholarship. To all these persons we particularly recommend the study of Dr. Conrad's volume. It will not show what wonderful contributions have been made to knowledge during the past fifty years, nor the effect of university education upon the political and religious condition of the country. It will introduce the reader neither to great books nor to great men. But it will reveal the results of academic administration in bringing together large bodies of teachers and students, and of holding them by positive restrictions and requirements to prolonged and systematic study.

We hear a great deal of the freedom of academic life in Germany, *Lehr-freiheit and Lern-freiheit*, and especially from those who would carry the elective principle through all our institutions of learning; but, in the German-university system, laws and regulations, traditional, political, and institutional, are to be met with at every turn. To begin with, the establishment of a university does not depend upon the bounty of a millionnaire, nor upon the religious zeal of some ecclesiastical body. Universities are not established to bring fame to private individuals, to give value to corner-lots, or to make a local school for boys or girls appear to better advantage because it bears an aristocratic name. In this country, the name university is not protected by law or by tradition; and authority to confer the rights and dignities of academic degrees can be secured in most states more easily than a charter for a horse-railroad or a bank. But in Germany, since the first foundation at Prague in 1348, only forty-two universities have been established; and of these, sixteen, for various reasons, have been given up, or combined with other institutions. Only three new foundations have been laid in this century, — at Berlin, Bonn, and Munich; and of these, the two last were based on earlier undertakings. The new university at Strassburg is, in fact, the revival of an old name. There are to-day, in so much of Germany as constitutes the German empire, but twenty-one universities, — ten in Prussia, six in South Germany, four in the minor confederated states, and one in the Reichslande; but what a score they are![1]

[1] The map which we have reproduced from this volume shows their geographical position.

The restrictions placed upon the establishment of universities are equalled by those which control their interior organization, their distribution into faculties, their responsibility to the government, their employment of funds, their modes of instruction. So also even the boasted freedom of students is a freedom based upon law which would seem tyrannical to the American public. The university portals are not open to every one. Those who would enter them, if belonging to the country, must bring the final certificate of the gymnasium; and that cannot usually be acquired without eight or nine years of rigid discipline in a school where the studies are obligatory, and where every hour of every week has its appropriate pre-appointed task. Great opposition has been made to the admission of students from the real-schools to the universities, especially in Prussia; and the controversy, in respect to the essentials of a liberal education, is still in progress, with a tendency, so far as we are able to judge, toward the re-affirmation of the principles of gymnasium instruction, and the belief that this is the only fit introduction to university privileges.

From these general remarks, we proceed to gather from the copious stores before us some statements in detail which may interest those who have not access to the pages of Dr. Conrad. Noteworthy fluctuation has been apparent in the attendance at German universities. At the end of the *twenties* (1821–31), the number of students was extraordinarily large; at the beginning of the *thirties*, there was a great and sudden decrease; in the *seventies*, a powerful increase; and the causes of this ebb and flow are an interesting field for trained conjecture. The drift of students toward Berlin, Leipsic, and Munich is remarkable, these three universities having forty-two per cent during the last *semester* which was under review. There has been an increase in the number of foreigners in attendance, but the importance of this element has relatively decreased during the last twenty years. In 1880 there were a hundred and seventy-three students enrolled from the United States, — mostly devoted to the philosophical faculty. The 'migrations' of German students are a very interesting subject of investigation. Just now north Germans go to the south, much more than south Germans go to the north. "It is the fine scenery, the mild climate, the geniality of south Germany," which prov attractive. "The desire to study at a l universit

give Leipsic its advantages. An attempt de to discover the social position of the rs of students, but without much result, ɔt in respect to Halle, the author's own e. His conclusion is, that it is "the m for people who have had a university ıtion" to give their sons like advan- ; and, when an unusual increase in at- ınce is apparent, it is due to a recruiting the families of subordinate officials, ele- ary teachers, etc.: though it is also ob- that people in the higher walks of busi- send more students to the universities han formerly.

pass by what is said in respect to the faculties, in order to give such space as n command to the philosophical faculty, nportance of which has increased actually elatively. The time is almost within the ry of our older contemporaries when student belonged to one of the three ies of law, medicine, or theology; and if o followed lectures in the philosophical tment, it was as supplementary or pre- ary to his professional course. All this w very different, in consequence of the ous importance which science has gained whole development of our culture. In years the number of students of science creased tenfold: the students of philos- and history have not yet been tripled, ven they have increased faster than the nts of medicine. This faculty also shows rgest increase in the number of teachers, at at present more than half the entire ng-body at all the universities belong philosophical group. The new founda- are especially for comparative philology, n languages, archeology, Egyptology, aphy, agriculture, etc. The professor- of history have been increased with refer- o better instruction in modern history. rcising-classes,' seminaries, private train- hools, are coming more and more into , as complementary to the ordinary lec-

"We admit to the teaching-office only f proved ability and capacity to promote ng. This is the sole test." Some would hink that "too little weight is attached ver of communicating, and that too ex- e regard is had to literary activity."

se who would see with what painstaking cy the statistics which underlie these ents have been brought together, must the volume itself. We have only en- ed to arrest attention to the many tive lessons with which the work ds.

THE CHANGE IN THE GREAT NEBULA IN ANDROMEDA.

THE remarkable change in the great Andromeda nebula, discovered by Dr. Hartwig, the news of which has just been received by cable, is an event of capital importance to astronomy. It will be a disappointment if it should fail to afford substantial aid in directing conjecture, and narrowing the field of hypothesis, as to the construction of the sidereal universe; a problem in regard to which our present knowledge is so defective, that the imagination has hitherto wandered, guideless, in a vague region of speculation.

The sudden appearance of a star of about the eighth magnitude, in the middle of this well-known object, is a phenomenon which, although extraordinary, is not unique in astronomical history. An exact counterpart seems to be furnished by the star, which, in May, 1859, suddenly shone out in the nebula or cluster 80 Messier. The analogy is so striking, that it is worth while to recount the various features presented.

The object 80 Messier, or 4,173 of Sir J. Herschel's general catalogue, was described by its discoverer in 1763 as a '*nebuleuse sans étoiles.*' Sir W. Herschel characterized it, however, as the richest and most condensed cluster in the heavens. Other observers, including Sir J. Herschel, Argelander, d'Arrest, and Pogson, have always described it as cometary or nebulous. In ordinary telescopes, and with moderate powers, it is certainly irresolvable. I am very familiar with its aspect in the six and one-fourth inch Clacey refractor in the west dome of the Harvard observatory, having had occasion to examine it, and the surrounding region, a great many times in observing the variable stars R, S, and T Scorpii. I have always seen it as a beautiful, bright, circular, nebulous mass, running up towards the centre into a strong condensation of light.

It was nearly in the middle of this nebula, that Auwers, at Königsberg, found, on May 21, 1859, a bright star, which, on many previous occasions, the last only three days previous, had certainly not been visible. He estimated it as 7th magnitude, and Luther as 6.5. On May 25 it had become sensibly fainter. It was independently discovered by Pogson, in England, on May 28, when, on looking for the neighboring known variable stars, he was startled to find in the nebula itself a star of the 7.6 magnitude. He is certain that on May 9, his last previous examination of the

region, the nebula had presented its usual appearance, and that here was nothing stellar about it. By June 10 the star had vanished; but the cluster seemed to shine with unusual brilliancy, and a marked central condensation. Since that time the object has been closely watched by Schmidt at Athens, who examined it at least one thousand times between 1861 and 1877; but the star has never been seen. Spectroscopically observed by Col. John Herschel, on April 13, 1868, the nebula exhibited a continuous spectrum.

The only other similar case that I am aware of, is the variable R Monocerotis discovered by Schmidt in 1861. It is situated in the southerly end of a faint cometary nebula. The phenomena presented are, however, much less striking, more resembling those of an ordinary variable star. Schmidt has seen it as bright as 10th magnitude. I have never found it brighter than the 12th; and ordinarily it is invisible, or very near the limit of visibility (which I arbitrarily assume to be 13th magnitude) of the six and one-fourth inch Clacey refractor.

The future developments in regard to the new star in the Andromeda nebula will be followed by astronomers with the greatest interest. This event, too, should draw attention to a subject of observation which has been entirely neglected. Hitherto, the question of nebular variation has been confined almost entirely to examination of evidence of fluctuation in the apparent brilliancy of the nebulous appearance itself. But the peculiarities in telescopes and observers, and variations in personal, atmospheric, and other conditions, render it very difficult to decide upon such evidence. Consequently, while there are one or two nebulae in which, perhaps, a change appears somewhat probable, the subject is surrounded with uncertainty and difficulty. A more promising field, however, is opened in the examination of known nebulae to detect the existence, and estimate the brightness, of stellar nuclei; since we have satisfactory means of comparison and measurement of this kind. Fortunately, this is a kind of observation which needs for its proper prosecution only an ordinary telescope. In the investigation of the variable stars, Argelander's method of observation has proved, in precision, convenience, and fruitfulness, superior to any photometric apparatus yet devised. A new application of it is here suggested, which, it is hoped, will give employment to some of the idle telescopes in the hands of amateurs.

Cambridge, Sept. 7. S. C. Chandler, Jun.

THE ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS.

The second meeting of this association was held in Washington, Sept. 1-2. In the absence of the President, Prof. S. W. Johnson of New Haven, Dr. H. C. White of Georgia presided. Delegates were present from most of the states exercising control or inspection of fertilizers. A number of other chemists interested in agricultural analysis, but not occupying official positions, were present, and took part in the proceedings.

Commissioner Colman, in an introductory address, spoke of the importance of securing uniformity of action among chemists, not only in the analysis of fertilizers, but also in all analytical processes pertaining to agricultural chemistry. He referred to the impetus which scientific agriculture had received from the labors of Liebig and his successors. He believed that all experimental agricultural work should be accompanied by careful chemical control, without which its full value could not be secured. He thought that the general government ought to co-operate with the state governments in passing the most stringent laws against the adulteration of foods. Continuing, he said, "In so simple a matter as the adulteration of milk, it would be hard to secure a conviction in a court of justice for any person practising it, because of the absence of any official standard by means of which the extent of the adulteration could be measured. It should be the object of the chemical control of agriculture, not only that abundant crops should be produced, but also to see that the products of the fields should be delivered to consumers free of any cheap or deleterious adulteration. The frauds that are practised upon the public in adding cheap, and frequently harmful, ingredients to the food we eat, ought to be exposed in no uncertain way. To such an extent is the adulteration of butter, and the manufacture of a counterfeit article, carried on, that the great dairy interests of our nation are now almost prostrate. Many an honest producer has become bankrupt in trying to keep up with his unscrupulous competitor."

After the commissioner's address, Mr. E. H. Jenkins, chairman of the committee on the method of estimating phosphoric acid, reported the results of the labors of the committee during the past year. He gave first a review of all the new processes which have been suggested for determining phosphoric acid. Samples of various kinds of phosphates had been sent out to the different members of the association in sealed packages, and the results of the analyses had been received and tabulated. In general, the agreement of the analyses was very satisfactory, especially in the amount of total phosphoric acid estimated. In the so-called reverted phosphoric acid, or phosphate soluble in solution of citrate of ammonia, the agreement was not so perfect. Nevertheless, the deviations from the mean were not any greater than could be expected from the nature of the material analyzed, and the difficulty of securing perfectly uniform results with the reagent employed. The com-

e suggested a few unimportant changes in the od adopted last year at Philadelphia, and which een practised by the members of the association such success during the past year.

H. W. Wiley presented the report of the com- e on the method of estimating potash. The art of the report was devoted to a review of all ifferent methods of estimating potash which been proposed during the last twenty years. a discussion of the merits of the various meth- xamined, the committee decided that none of was superior to the method adopted by the iation at its Philadelphia meeting. They rec- ended, therefore, that with certain slight mod- ons, consisting more especially of the insertion e details of the manipulation, the Philadelphia od should be continued. The only important es which were introduced were in directing the nent of the sample with hot water, for the ex- on of the potash, instead of water acidulated hydrochloric acid; in the addition of a small n of oxalic acid to facilitate the conversion rates into carbonates; in the recommendation ndon the washing out of the double chloride by ater after its first weighing, a process which, perience, had been found to be unnecessary; and ommending the continuance of the factor 30.56 e conversion of K_2PtCl_6 to KCl instead of the 30.67, which would be the proper one if the c weight of platinum, as determined by Seubert, e correct one. The committee, in making this mendation, did not wish to be considered as in ay criticising the accuracy of Seubert's work.

F. C. Clarke stated, that, in his opinion, 195 ented much more nearly the atomic weight of um than 197, and that, therefore, the larger of o factors given above would be the more correct r computing the amount of potassium chloride the double platinic chloride. The report of the ittee was adopted for the guidance of analysts the coming year.

F. H. Gladding read a paper on a new method imating potash, which was ordered printed with roceedings.

P. E. Chazal presented the report of the com- e on determination of nitrogen. He stated that mmittee was quite dissatisfied with the results ir work, and hoped that the association, without any action whatever, would refer the whole r to another committee, to be presented at the annual meeting. The recommendation was ed.

following officers were elected for the coming President, H. W. Wiley, Washington, D.C.; resident, C. W. Dabney, Raleigh, N.C.; secre- nd treasurer, Clifford Richardson, Washington,

following committees were also appointed: itive committee in addition to the above offi- —H. A. Huston of Indiana, and W. J. Gas- of Virginia. On phosphoric acid: H. C. White orgia, E. H. Jenkins of Connecticut, W. C. s of Louisiana. On nitrogen: P. E. Chazal of South Carolina, J. A. Myers of Mississippi, W. E. Moses of Tennessee. On potash: W. J. Gascoyne of Virginia, Clifford Richardson of Washington, N. W. Lord of Ohio.

The convention discussed the proposition of enlarging the scope of the association, and it was the unanimous opinion of all present that this should be done in harmony with recommendations made in the address of the commissioner. The association then adjourned to meet in Washington at the call of the executive committee in September, 1886.

THE HISTORICAL ASSOCIATION AT SARATOGA.

Of the three hundred members of the association, about fifty attended the recent meeting (Sept. 8–10). In addition to those who played a more or less prominent part in its organization last year (*Science*, No. 86), there were present at one or more sessions, Goldwin Smith, Gen. Cullum, Washington Gladden, Henry Adams, Henry C. Adams, Eugene Schuyler, Rufus King, Professors Gurney, Andrews, James, and Coman, Nathaniel Paine, S. S. Green, E. M. Barton, and Mrs. Lamb. The old officers were re-elected with the exception of George Bancroft, who took the place of Andrew D. White as president for the next meeting, and Professors Franklin B. Dexter and W. F. Allen, who succeeded to the places on the council left vacant by the retirement of Professors Tyler and Emerton. The finances of the association are in a flourishing condition, there being over a thousand dollars in the treasury at the close of the first year. The council elected the German historian Ranke, the first, and, for the present at least, its only honorary member.

The papers presented were mainly upon subjects connected with American history; and it is greatly to be desired, that the scope of the association's work should be enlarged, and that more essays should be presented dealing with European history. Apart from this, the most noticeable feature of the meeting was the great desire shown by the members to gather in small groups, and exchange ideas. This deserves encouragement; and it is hoped, that, at the next meeting, less time will be given to the reading of papers, and more opportunity be afforded for social intercourse.

President A. D. White opened the first session with some comments, or a syllabus of an essay on the influence of American ideas upon the French revolution. He was followed by Professor Goldwin Smith of Toronto, who endeavored to show by the history of Canada that the American revolution was a mistake, and that a peaceful separation, which time would have brought, would have been better. These two papers occupied the morning session. In the evening, Jeffrey R. Brackett, a graduate of Harvard, presented a report on certain studies of the institution of negro slavery, which he is now making at Johns Hopkins. He especially advocated the study of the blacks as a race, and laid particular stress upon the danger of

relying too implicitly upon the statute-books for data; as the mere fact of a law being among the statutes of a particular state is of little importance unless one knows whether the law was executed or not.

Mr. Justin Winsor then referred to an Italian portolano of the sixteenth century, which had recently been acquired by the Carter-Brown library of Providence, as probably the only specimen of an early sea-atlas now preserved in an American library. It has five maps showing the American continent, two of which illustrate the theory which made North America and Asia identical. The atlas resembles what is known as the Charles V. portolano, and is also like another now in the Riccordiana in Florence. The dates of these, as understood, led Mr. Winsor to place this new specimen somewhere between 1540 and 1550; and the condition of geographical knowledge shown in it comports with such a supposition, a due allowance for the errors and limitations always found in charts of so early a date being made. After, Mr. H. Tuttle of Cornell presented a long bibliography of materials for the history of the reign of Frederick the Great of Prussia, which have appeared since Carlyle wrote, and which may be considered as justifying a new life of that potentate. Professor Ephraim Emerton, in a ten-minute report on the value of Janssen's History of the German people during the reformation period, aroused considerable interest. President White agreed with Dr. Emerton as to the deceptive methods of presentation adopted by Janssen, and compared it to a history of the late civil war, in which the main accent should be laid upon a few over-fervid utterances of Garrison, Phillips, and Pillsbury; upon Mr. Seward's false prophecies, Mr. Lincoln's story-telling, the personal habits of some union generals, and the like. Prof. E. B. Andrews, while agreeing with the previous speakers, said that such books were useful as throwing a side-light upon the real character of the reformers and the reformation. In concluding, he warned all students who read German books, or who go to Germany to study, to beware of the dogmatic tone of many German historians. Professor Goldwin Smith also contributed to the discussion.

The next morning the Rev. Dr. M. C. Tyler read an abstract of a paper by the bishop of Missouri on 'The Louisiana purchase, and its influence upon the American system.' The abstract showed that the paper was one of great value; but as Mr. Henry Adams remarked, the subject was one that could be properly treated only in volumes, and not in a single essay, even so complete as the one just presented. He thought, however, that more stress should have been laid on the fact that the acquisition of Louisiana, by an extreme use of the treaty-making power, did, in fact, create a new union upon a broader basis than the original union as defined by the constitution of 1787. Judge Douglas Campbell and Mr. Rufus King followed in the discussion.

Mr. John Addison Porter then read an abstract of an essay, which will appear shortly in the Johns Hopkins' series, on the origin and administration of the city of Washington. Particular attention was paid to a critical analysis of the 'Shepherd ring.' He added that the federal city and district owe their present names to the commissioners who served with Washington in planning the city.

The evening session was opened with a discussion of the problem of municipal government, until Mr. Schuyler declared, that, in his opinion, such discussions were hardly within the province of an historical association. This was followed by a number of reports; and then Mr. Irving Elting of Poughkeepsie, the first announced speaker of the evening, read a well-written abstract of a paper on the Dutch-village communities of the Hudson River, which he thought exhibited, during colonial times, many of the peculiarities of the primitive German mark. The towns of Hurley and New Paltz were instanced as typical communities. In the former, the common lands were divided so as to give mere residents, as well as free-holders, a share in the allotment; while in New Paltz, the ancient institution of the 'Twelve men' survived even into the present century. The remainder of this session was occupied with a discussion of the origin of *vlie*, bowery, and kindred words. The latter, Mr. Elting said, meant simply 'home-lot.' By this time it was so late that the association adjourned, after having disposed of but one number of the programme as announced on the posters.

The next morning Dr. Josiah Royce gave the substance of a chapter from his forthcoming work on California. He demonstrated by documents which have been discovered by Mr. H. H. Bancroft and himself, that the original purpose of our government was to get California from Mexico through peaceful intrigue, and by the act of its inhabitants. To this plan the operations of Captain Fremont were in actual opposition; although the speaker did not in this paper undertake to criticise Captain Fremont's acts, nor to explain them. After some remarks by Mr. W. A. Mowry, on the influence which the acts of the agents of the Hudson-bay company may have had on our government in its dealings with the Californians, Dr. J. F. Jameson of Johns Hopkins read a paper advocating the more careful study of the constitutional and political history of the several states. Dr. E. Channing followed with a few suggestions as to the value of the study of the historical geography of the territory comprised within the present limits of the United States.

Our reporter was not present at the evening session, but, through the kindness of Mr. E. Schuyler, is able to give a brief account of the latter's paper on 'Materials for American history in foreign archives.' It seems that the increased study of original documents during the last fifty years has led to great reforms in the management of the European state-paper offices, which are now well arranged, and easily accessible to students. Various nations, especially England and France, have filled in the gaps in their own collections by copies from papers preserved elsewhere. The reverse of all this Mr. Schuyler declared to be true of our own state department, which has the distinction of keeping its archives less accessible than those of any European nation, — an assertion which was borne out by Dr. Royce's relation of

perience while searching for the well-known
n despatch.' In closing, Mr. Schuyler de-
that if the papers now unpublished, and hid-
m the world in these great foreign store-houses,
printed, the history of the American revo-
and of the early years of our country, would
be entirely re-written. He asked the associa-
petition the government to catalogue all papers
ble in foreign countries, and to transcribe and
hose that are of importance.

PUPPET-SHOWS IN JAVA.

Javanese take great delight in theatrical per-
ces. One form of these is the Wajang, or pan-

BEHIND THE SCENES AT A PUPPET-SHOW IN JAVA.

es, where the actors are represented by puppets
by a man called the Dalang, who recites all
rts. For the performances a curtain is erected,
ich the shadows of the puppets are thrown.
omen are placed on one side of this curtain,
alang on the other. At his right sit the
nd at his left the young people. By this ar-
nent, only the men see the puppets directly:
omen see only the shadows. Behind the Da-
the orchestra; and around him are scattered his

Translated from *La nature*.

stage properties, and a jar in which incense is burned before the performance, and a copper basin to receive offerings to the spirits (which consist of food, of which it is thought the spirits eat the immaterial part, although in fact the Dalang or one of the musicians takes it home).

The puppets are about two feet high, and are made of very thick buffalo-leather, or carved from wood, painted all sorts of colors, and sometimes gilded or silvered, those highly ornamented representing people of rank. Their forms are hideous, and have nothing human about them. The arms, which are movable by little rods attached to the extremities, and hands, are very long and narrow; the face is pointed, and resembles the beak of a bird (some, however, are round, and decorated with a huge nose and teeth); the eyes are either narrow and long, or large and round; and some have an enormous stomach, while others are hump-backed. These forms explain themselves; for they can only represent conventional types well known to the people, whose characteristics are exaggerated in order the easier to be recognized.

The origin of the puppets, according to the Javanese, is as follows: One morning, while a woman was engaged in washing her rice, she saw the trunk of a tree floating toward her. She tried to push it

off; but, in spite of her efforts, it kept coming back. Finally she drew it to the bank. Three days afterward she had a vision, in which she heard a human voice complaining, and demanding to be released from the trunk of a tree in which it was enclosed. The woman told her husband of her dream, and they concluded that the dream must refer to the tree which the woman had drawn to the bank. They brought it to the house, and cut it open, and found within a puppet similar to that of the Wajang Kalitik, which they named Kjaï Gandroung. Several days after, in a dream, the woman again heard a voice saying, "I am the wife of Kjaï Gandroung, and I desire passionately to be re-united to him." The woman asked her where she was, and was told that she was enclosed in one of the two trees before the house. On cutting off a branch of one of the trees, a very pretty puppet of the Wajang Kalitik was found. It was placed beside the other, and given the name of Njaï Gandroung. The man put them into a box, and then made a number of similar puppets after these two models. This box descended from father to son, and is at present in the possession of a Dalang of Pagoung, regent of Kediri. The two puppets are said to be in the same state as when found, and many poor people come to make them offerings in order to obtain the fulfilment of their wishes. When an extraordinary representation is desired, Dalang of Pagoung is invited to come with his chest containing the puppets.

Besides the performances where puppets only are on the stage, there is another kind of Wajang where the parts are taken almost altogether by women. It is called the Wajang Wong, or Ringgit Tijang; and the actors are dressed and painted to resemble the persons whom they are meant to represent. But they do not speak: the Dalang always recites their parts, while they only dance and sing.

THE RECENT TORNADOES.

The recent tornadoes, which the newspapers still persist in calling 'cyclones,' in Pennsylvania and adjacent states, seem to have had all the peculiarities of the typical storms of the west. The whirling funnel, or conical cloud, and the excessive destruction that accompanies its rapid passage along a narrow path, are clearly made out: the occurrence of several whirls near one another in south-eastern Pennsylvania on the afternoon of Aug. 3 is equally characteristic of this class of storms. The tornado in Philadelphia was well developed; and, by reason of passing over a thickly populated district, it proved especially destructive. A letter from Mr. S. E. Paschall of the Bucks county (Penn.) *Intelligencer*, describes the passage of three tornadoes in his neighborhood on the same day, one of which he regards as a continuation of the Philadelphia storm: when it reached the town of Churchville, it wrecked nineteen large and twenty-eight small buildings; it struck a cemetery, and scattered the tombstones, and even tore the bark from trees. Its course was a little east of north: the other two storms travelled north 35° east. It is with regret that one notes the absence of discriminate observation concerning the immediate mechanism of the tornado among the many newspaper columns given to the description of its general appearance and destructive action. Few observers who speak of the rotation of the conical cloud mention the direction of its turning: no one seems to have watched the downward extension of the cloud sharply enough to say whether its 'plunging' toward the ground was real or apparent, although it is probable that this important point might be directly determined by looking closely to see if the wisps or fibres of cloud at the base of the cloud rose into it or descended from it. It can hardly be doubted that the 'plunging' is only an optical effect of the growth of the cloud-forming space downward, faster than the cloud particles are carried upward; for heavy objects are carried high aloft in the centre of the whirl, and this could hardly be if the wind descended there. The circulation of the upper winds should also be determined by noting the motion of the clouds overhead at different times during the tornado's passage; for it is probable that much of the working of the storm is well above the ground, and that we feel only its most violent central action; and, if an observer be found, with presence of mind equal to doing all this while the tornado is roaring past, it would be well to notice whether the clouds above him are forming or dissolving. A tornado is an elaborate experiment, and very critical observation will be needed to follow all its action.

W. M. D.

THE BACILLI OF CHOLERA ASIATICA AND CHOLERA NOSTRAS.

We have received within a few days a copy of Finkler and Prior's latest work upon the curved bacilli of cholera nostras, and of cholera asiatica. (*Ergänzungshefte zum centralblatt für allgemeine gesundheitspflege*, 1885.) It will be remembered that these observers found in the discharges of patients, in an epidemic of cholera nostras, bacilli which they at first considered to be identical with the organisms found by Koch in cholera asiatica. Various slight differences in the behavior of the two organisms under cultivation were observed, and the paper before us contains the results of a great deal of work undertaken to prove the exact nature of the relationship between the two organisms. It contains chapters upon the morphology and behavior under cultivation of each bacterium. The differences between the two are well considered; and a full account is given of the inoculation experiments undertaken with intestinal dejecta, and pure cultures of the two bacilli.

The conclusions of the authors are given in the following *résumé*:—

1°. We have established the occurrence of Koch's comma bacillus in the intestinal contents, and dejections of cases of cholera asiatica in the epidemic of 1884, at Genoa.

2°. We have found comma bacilli in the dejections

of cases of cholera nostras: we observed them both directly in the intestinal contents, and by cultivation experiments, and studied their characteristics.

3°. Both these comma bacilli are vibrios, which form genuine spirilla. As well in this stage, as in the variations which the form undergoes, are the two vibrios similar.

4°. The behavior under cultivation of the two organisms is almost identical. They vary only under very limited differences of culture media and temperature: and the differences consist not so much in *absolute* as in *relative* variations; i.e., greater energy of growth and vitality of the vibrio of cholera nostras.

5°. Of the physiological properties of the vibrios we have especially remarked — and have clearly determined — their marked resistance to drying, varying temperature, and '*fäulniss*.'

6°. We claim the possibility of a resting stage, and consider it probable that this resting stage is similar to that of other micro-organisms.

7°. Both vibrios are pathogenic.

8°. The pathogenic property of Koch's vibrio is greater than that of the vibrio of Finkler and Prior. There is here also merely a *relative* difference.

9°. The pathogenic property does not exist for all species of animals: much the greater number possess an immunity against both vibrios; they are also pathogenic only under certain conditions. The susceptible animals, and the conditions for producing positive results, are the same for both vibrios.

10°. The symptoms produced in animals by these vibrios have great similarity to those of cholera in man; they are not specific, however, but can also be produced in guinea-pigs by other infectious materials and chemical poisons.

11°. The causal connection between the comma bacillus and cholera asiatica is rendered probable by its constant presence, but is not made certain by the results of inoculation experiments. The causal relationship between the comma bacillus discovered by us and cholera nostras, is rendered probable, first, by the discovery of the micro-organism, and, secondly, by the very great similarity between the symptoms of cholera nostras and asiatica, as well as by the similarity in biological and pathological properties of the two comma bacilli.

12°. The two vibrios can pass into the blood after injection into the intestine, and can be excreted in the urine. The situation of Koch's vibrio in the body so increases its rapidity of development, that a new point of resemblance under cultivation between the two vibrios is furnished.

These conclusions are all supported by the work which is recounted in the text, and which gives evidence of great care and much labor. As will be seen, the claim of identity between the two organisms is abandoned by the discoverers of the later one; and the differences are brought out as well as is possible at the present time. The strong point made by Johne and others of the constant difference in appearance of gelatine-cultures of these two organisms of the same age, is refuted by the authors, and would certainly seem to be completely upset if the figures they give be exact reproductions from nature. At least the differences in appearance between colonies in gelatine of the same age, cannot be taken as *diagnostic*, as some writers upon the subject would have had us believe. There are a number of very fine plates which accompany the book, and give beautiful representations of the microscopic appearances of the two organisms.

The work is very creditable to its authors in every way, and is truly refreshing to read after seeing all the hasty work that has been rushed into print upon the same subject. It cannot be said, of course, that the absolute specific nature of either of the bacilli under consideration has been determined — the positive results of the inoculation experiments were not sufficiently numerous to permit that. It is perfectly true, however, that this work has assisted materially in establishing the *probability* of their specific nature; and certainly results of such excellence can but do good in forcing others to attempt the same.

THE COAST-SURVEY AND 'POLITICAL SCIENTISTS.'

THE following letter from the New-York *Evening post* of Sept. 10 is in reply to an article in the same journal for Aug. 13, and reprinted in the *Nation* for Aug. 20. We reprint it here for the interest that it has to scientific men, and desire to call the attention of persons connected with the government to the passage which we have taken the liberty to print in italics.

The article on 'Political scientists' in the *Evening post* of Aug. 13, while it contains many wholesome truths concerning the management of scientific affairs in Washington, reflects with unnecessary severity on the administration of the coast-survey. This article, so far as it concerns the survey, is based upon a report drawn up by a committee of treasury experts, who condemn alike the organization, the methods and the expenditures of the coast-survey. While giving due weight to certain features of their report, we cannot expect that a committee so constituted, however competent to judge of business methods, should know the value of the scientific work upon which, from their point of view, money has been squandered.

Even when their criticism is just, the fact remains that the late superintendent is in no way responsible for the rules which control the general direction of his bureau. He inherited from his predecessors the superintendence of an old and well-trained *personnel*. This has not been materially changed during his administration. Mr. Hilgard did not enlarge the field of operations, but limited himself to the carrying out of plans already formed. In obtaining the appropriations necessary to this end, he relied greatly on the advice of his principal assistants.

In this connection it may be added, that the coast-survey is the only scientific bureau t ropriations for which are distinctly allotted t objects.

The superintendent has, therefore, little liberty of action. For instance, the very sums devoted to pendulum experiments, so strongly condemned by the committee, must have figured in the estimates submitted by him to congress. Neither could Mr. Hilgard be expected to reduce the coast-survey force, when appropriations, insufficient, it is true, to keep the force fully employed, were distinctly made to pay the salaries of the employees who had grown old in the service of the government. The publications of the coast-survey only contain communications strictly relevant to such investigations as were authorized by the appropriations. As to the experts living at a distance from Washington, such specialists have always been employed by the coast-survey. They have usually received a very moderate compensation for work carried on in addition to their usual avocations, — work which could not have been done otherwise except at great expense.

The article in the *Evening post* implies that the coast-survey has been a party to the distribution of scientific salt in the shape of gifts, such as photographs, chromo-lithographs, illustrated books, and the like, and has also done its full share in the way of personal favors to congressmen. Whatever have been the failings of the administration of the coast-survey, there never has been a 'political scientist' at its head; and the above charges are, so far as I know, absolutely false. My belief is based on an intimate association of many years with this department of government work.

The method of investigation adopted in this case seems somewhat autocratic. Even at this day the superintendent has not seen or been able to obtain a copy of the charges brought against him, having merely been requested to reply in writing to a number of questions. He himself, as well as the assistant in charge of the office, the disbursing agent, and the chiefs of two divisions, were suspended: in other words, disgraced, if not dismissed, before the investigation was begun. Some of these officers had served the department faithfully and intelligently for nearly forty years. Such off-hand condemnation of a bureau from which so much work has gone forth of a character most honorable to the science of the country, is surely to be deprecated in itself, and can hardly be considered by scientific men as less than an outrage upon them all. They have a right to ask that the wholesale imputations thus cast upon official science should be carefully verified before they are accepted.

Thus far the scientific public has received the report of the commission through the newspapers alone, and the press has been liberally supplied with inaccurate and *ex-parte* statements in regard to the investigation into the coast-survey affairs. Their dictum upon the late superintendent, at least as far as his professional career is concerned, is answered by his position as an investigator in the scientific world. In this jury, called for the express purpose of deciding upon the value and efficiency of scientific work, men of science have had no voice.

On several occasions attempts have been made, through the medium of the National academy of sciences, to revise the organization of the scientific bureaus according to a comprehensive plan, which might remedy the evils of the present system. A committee of congress has at last taken up the matter, but nothing of value has as yet been effected; nor have the recommendations of the academy had the least weight with government officials, or with members of congress. No member of the cabinet has availed himself of its councils, though the academy was especially chartered by congress to be the scientific adviser of the government. Since its organization, superintendents of the coast-survey, of the nautical almanac, of the signal-service, of the geological-survey, and of other scientific bureaus, have been appointed without consultation with the men of science in the country.

We do not ask that a scientific bureau should be absolved from the requirements of ordinary business methods, or that the dictates of common sense should be forgotten in its administration. Scientific men can only sympathize with the efforts of the administration to reform the management of the scientific bureaus at Washington. They protest merely against ignorant interference with scientific affairs. Is the superintendent of the coast-survey, the head of the nautical almanac, the director of the geological-survey, or the secretary of the Smithsonian, to submit the scientific expenses of these bureaus to the judgment of a clerk in the auditor's department? The necessary appropriations having been made, is that department, or any member of it, to decide upon the value of the scientific work thus provided for, or upon the method of its execution? Surely such an alternative would be worse than the state of demoralization said to exist now in our scientific bureaus. If this be the nature of the contemplated changes, they can only be dreaded by the friends of science.

The surveillance can hardly be too strict; but let it be intrusted, so far as scientific work and methods are concerned, to men who have some training in both. Undoubtedly there is much which should be changed at Washington with a view to introducing a proper co-ordination among the different scientific bureaus. But the blame for this does not rest on the 'political scientist' alone. The former secretaries of the interior, of the treasury, of war, and of the navy as well as congress, are partly responsible for the existing confusion and inefficiency; they have tolerated a duplication of work which has little by little brought about the present state of things.

One word more as to the character of the work done by the coast-survey. Professor Bache himself was perhaps the most successful of all the heads of our scientific bureaus, in obtaining from congress the appropriations necessary to the maintenance and efficiency of his department. He and Peirce originated the very scientific investigations now decried by the committee. Their successors have only carried out the methods and the physical experiments which they deemed necessary. Are these to be abandoned because a treasury expert has seen fit to condemn valuable experiments, and to indulge in a few cheap jibes about 'swinging the pendulum?' That he

should not see the use of such experiments is quite natural. To one who does understand their importance, the wonder is that such an opinion should have any weight in such a matter. The standard in the early days of Bache is still the standard of the coast-survey work of to-day. Let us hope that no ignorant criticism will have power to lower or impair the efficiency of a department of whose scientific record the country may well be proud.

While criticising the article of the *Evening post*, so far as it relates to the coast-survey, let me express my complete agreement with its condemnation of the 'political scientist.' It is time that the system thus attacked should be abandoned, and that indiscriminate scientific assistance, given by the heads of bureaus to institutions and individuals, and never contemplated or sanctioned by congress, should be discontinued. It has brought nothing but discredit upon the official science of the country. Let the most liberal appropriations be made for the work of our scientific bureaus, but let the requisitions be so complete and detailed as to invite a fair and open criticism.

ALEXANDER AGASSIZ.

Cambridge, Mass., Sept. 9.

THE THEORY OF VOLCANOES.

THIS work is a brief statement of the most general facts relating to volcanoes, with the citation of many examples of volcanoes of various classes, and their subordinate phenomena, by way of illustration. It is evidently intended for the most intelligent class of general readers, though valuable also to the specialist.

In the first chapter, Mr. Vélain describes the phenomena attending a volcanic eruption of the normal type, and with great propriety treats such an occurrence as a manifestation of the energy of the elastic vapors contained in the erupting materials, — a fundamental fact which should always be impressed as forcibly as possible upon the general reader. He also describes the various forms given to the lavas, the modes of accumulation of volcanic piles, the formation of cinder-cones, and the many forms of craters. He gives descriptions of some of the more remarkable eruptions of which records have been preserved, and these are chosen so as to illustrate the typical cases of the several classes of volcanoes. In this chapter may be found much information about volcanoes not described in English treatises on this subject, such as those of Reunion and the Island of St. Paul.

The second chapter, on the gaseous emanations, is, to the American student, probably the most instructive one in the book. The investigations of Charles Saint-Claire Deville, of Scacchi, of Fouqué and Levy, are set forth in considerable detail, and well summarized. These are of great importance, and have, no doubt, received less attention from writers in the English language than they are entitled to. It may be remarked, however, that much more extended observations upon this class of phenomena are needed than those upon which the conclusions of Deville and Fouqué are founded. The pre-eminence of those investigators is a high warrant for the validity of their conclusions; but the experienced vulcanologist will perhaps feel that they are even more systematic and beautiful than he is accustomed to find volcanic phenomena to be, and he would like to see them tested by the widest possible verification. The whole chapter is admirable reading, and excellently arranged by Mr. Vélain.

The third chapter describes the lavas themselves, their methods of flow, and the forms they assume at solidification. Very little effort is made to describe the micro-characters of the lava, and this was probably judicious on the author's part; for these characters cannot be briefly summarized, and any attempt to do so would have exceeded the scope of his work.

The fourth chapter treats of the geographic distribution of volcanoes. The main fact he seeks to establish is, that volcanoes are, with the rarest exceptions, situated near the sea, or within it. At considerable length, and with reference to this generalization, he passes in review all the lines of active vents in the world. As a mere statement of facts, apart from any conclusions, his summary, though not free from errors, is a valuable one on many accounts: considered with reference to his generalizations, his treatment of the subject is open to grave criticism. One of the most important and comprehensive propositions he insists upon, is the linear arrangement of volcanoes. This idea has certainly a large amount of truth in it, but it has been enormously overloaded and overworked by writers of general treatises. The occurrence of half a dozen to a dozen small cones upon a single line of fracture twenty-five to a hundred kilometers in length, is very frequent in districts where the volcanic action has been diffuse. But a linear arrangement on a grand scale is another matter. The strongest case of it which can be cited is in South America, where many volcanoes are scattered in a most irregular array along the Andes; but no evidence has yet been brought to light, that any six, or even any three, of them have been built

Les volcans, ce qu'ils sont et ce qu'ils nous apprennent. Par M. CH. VÉLAIN, docteur des sciences, maître de conférences à la Sorbonne. Paris, *Gauthier-Villars*, 1884. 8°.

up over the same line of fracture. Viewed in their totality, they occupy a belt of country which is very long (over four thousand miles), and relatively narrow. Any one can judge for himself how far this arrangement is linear. Much the same may be said of the whole circuit of the North Pacific. In this volcanic girdle, there are many distinct volcanic areas, and more or less elongated belts; but the intervals between them are wide, and no inter-dependence has hitherto been shown to exist. Of course a line can be drawn through them all if it be crooked enough, and makes no note of the enormous gaps and *echelons*.

The generalization that volcanoes are near the sea, or in it, has also been overstrained. How far from the sea may a volcano stand, and still be said to be near it? If we say ten miles, then very few land-volcanoes are near the sea. If we say two hundred and fifty miles, then the statement holds good, but is shorn of a large part of its meaning. The reader must judge for himself whether a point a hundred and twenty miles or more from the sea is 'near' it; and the great volcanoes of North and South America are, on an average, about that distance from the ocean. Even in this qualified sense, the statement ceases to be true the moment we recur to those volcanoes which were active in middle and late tertiary time; for many of them in our own country were five hundred to a thousand miles away from any body of water, and those of central France and Germany were almost as far from the ocean as the configuration of Europe would permit.

The last chapter of Mr. Vélain's book, and the briefest of all, treats of the causes of volcanic action. In common with many others, he regards as the most acceptable view that lavas are squeezed out of a melted nucleus through a rocky crust by the contraction of the earth's interior by secular cooling. C. E. Dutton.

BOLTON'S CATALOGUE OF SCIENTIFIC SERIALS.

It can hardly be true, that the series of scientific publications, whether in the form of independent journals, or as publications of societies, can be found more complete in American libraries than in European; but it certainly has fallen to the new world to give to the old the best lists of such periodicals extant. Scudder's 'Catalogue of scientific serials,' published in 1879, was almost the first attempt to embrace in one volume the bibliography of publications of this class; and the present volume, which brings the literature down to the close of the year 1882, has improved in many respects upon its predecessor. Especially is this the case in the fulness of the titles. The difference between these two publications is principally in that Scudder's catalogue was mainly restricted to pure science, while Bolton's extends to nearly all the fields of applied science, excepting medicine; but, on the other hand, with few exceptions, it does not include serials published by learned societies. The pains taken by Dr. Bolton is evident on every page of the catalogue, and it will long remain a most important auxiliary to every scientific library.

Besides various forms of index which add markedly to its value, especially the library check-list, enabling one to find at a glance where in America a given series may be found, we desire to call special attention to the chronological tables which follow directly the main list. In this, Bolton has followed a suggestion made many years since by Dana, but never hitherto carried into effect: it indicates the exact year for which each volume of certain long series of publications was issued; and it is an interesting study to see with what ingenuity the various changes undergone by such publications as the Edinburgh philosophical magazine for instance, with its various splits and absorptions, have been tabulated. In this list are included about five hundred of the most important journals; and it will save a vast amount of labor on the part of many a writer, who, with an eye to 'priority,' will wish to know in what year a certain volume of a given publication was issued.

The only criticism, which, it appears to us, can be made to the work, is on a matter which deals purely with typography. The type is much larger than is requisite or convenient for such a purpose, expanding the volume to nearly eight hundred pages: had it included, as we certainly wish it had, all publications of societies, its extent must have been doubled, and its bulk altogether unfortunate. This fault is especially seen in the chronological tables, which should have been compressed to nearly one-half their present space. It is one of the prime qualities of a good index, that it should be as compact as possible; and these tables, sharing as they do the nature of an index, ought thus to have been compressed. These, however, are faults only of style: concerning the body of the work, its method

A catalogue of scientific and technical periodicals (1665-1882), *together with chronological tables, and a library check-list.* By H. C. Bolton. Washington, *Smithson. inst.*, 1885. 8°.

and its execution, we can have nothing but praise. Dr. Bolton has laid the scientific men of the whole world under a deep debt of gratitude; while those who really know the severity of the task he has so faithfully accomplished, will be forced to acknowledge that painstaking is not confined to Germany.

THE FIFTH VOLUME OF OHIO GEOLOGY.

THE fifth volume of the Ohio state geological report, crammed almost to bursting with extremely valuable information, up to more than eleven hundred pages of wretchedly thin paper, poor printing, and coarse illustrations and maps, puts us in doubt which to wonder at most, — the unenlightened niggardliness of the great wealthy pork-raising state of Ohio, or the intelligent, generous zeal of its few geologists. They, indeed, have evidently been urged on by self-sacrificing devotion to learning, and, far beyond what could have been expected from the petty means given them, have filled their measure to overflowing with knowledge that is either immediately and obviously useful, or of less direct, but wider, more manifold, and of more lasting utility.

About seven hundred pages of the report, themselves enough for a bulky tome, are the work of the able state geologist, Professor Edward Orton, done "in conjunction with the duties of his professorship at the state university;" for, of course, the state could not afford even to employ the chief of so important a survey on full time. He discusses in a hundred and twenty-eight pages the stratigraphical order of the lower coal-measures in Ohio; in forty pages, their coal-beds; in three hundred and fifty-two pages, the mines upon them, county by county; in sixty-five pages, the iron ores of the state, geologically and geographically considered; and in sixty-five pages (collaborating with Dr. G. W. Hawes), its building-stones, especially the celebrated Berea grit. He wisely avoids attempting to assign numbers to the different coal-beds, — an impracticable or impossible task, since they thicken up in so many places, or thin out and disappear, — and adopts the local names already in use in western Pennsylvania, where steeper valleys, with less drift and more frequent exposures, have earlier enabled the order and identification of the beds to be correctly made out. He maintains that the coal-beds never extended much, if at all, beyond their present northern boundary, and that the great basin gradually contracted by general elevation, and argues that their thickest portions are confined to their borders. He has to point out that more careful surveys reduce the formerly supposed extent of the workable coals. Rarely are there more than one or two workable coal-beds at any one spot; and there is great loss of coal from tenderness, impurity, or a poor roof or floor, as well as from lack of proper care. He shows (p. 263) that a considerable disturbance occurred near the end of the lower coal-measure period in Tuscarawas county.

The state chemist, Prof. N. W. Lord, besides twenty-eight pages on the chemical work of the survey, including fifteen pages of tables of analyses, contributes an admirable chapter (a hundred and seventeen pages) on the iron manufacture of the state, noticeable for the extent to which raw bituminous coal is used, and in the hanging-rock region for the amount of charcoal-iron still made. In spite of some deficiency in rhetoric (so apt, with language, grammar, and logic generally, to be neglected by scientific men, to their own immense disadvantage in respect of easy mental work as well as to the discomfort of their readers), he certainly has the root of the matter in him; and his thorough comprehension of the subject results in sound practical advice. Good sampling gives much greater value to the analyses than any in the previous volumes have.

The state geologist's son, Mr. E. Orton, jun., gives an excellent chapter (seventy-nine pages) on the clays and all their manufactures, from common brick up to terra-cotta; and one (twenty-five pages) on the coals of Coshocton county. The former state inspector of mines, Hon. Andrew Roy, contributes a very good treatise (seventy pages) on the coal-mining of the state, including some notice of the coal-cutting machinery that is gradually coming into use. He has, too, a dozen pages on the coals of Jackson and Wellston. There are also a very good chapter (twenty-two pages) by Mr. H. Newton on coke-making; one (twenty-eight pages) by Mr. E. McMillin on the gas-coals; one by Prof. G. F. Wright (twenty-three pages) on the glacial boundary, pointing out that it separates better soils on the north from poorer ones on the south; one by Prof. A. A. Wright (twenty-seven pages) on the coals of Holmes county, with the scales of its numerous columnar sections, each carefully marked, — a convenience wanting to many sections and maps in the other coal chapters; and one (twenty-nine pages) by Mr. C. N. Brown on the Meigs-Creek coal of the upper coal-measures, very full in local details.

The practical utility of geological surveys is incidentally illustrated at several points in the volume, where it is shown that money, up to more than a million dollars in a single case, might have been saved by a good preliminary examination of the circumstances.

The world (if Ohio does not) must needs feel very grateful to Professor Orton and his assistants, some of them not contributors to the volume, for their largely gratuitous and very successful labors, and, congratulating him and them on having accomplished so much with such limited time and means, must hope that he may soon find himself able to publish at least one more volume on the several other economical subjects of high importance necessarily neglected this time.

THE WINDMILL AS A PRIME MOVER.

This treatise is intended to present the theory and the practice of construction and use of windmills, the history of this form of prime mover, its progress and development, and the economy attained in its application to the production of available power. It is a careful and conscientious study of the machines in use, of the theory of the transformation of the available energy of wind for purposes of application, and of the commercial aspect of the case.

Here will be found an account of the extent to which windmills are used, and of the comparative value of these forms of motor and the steam-engine, the theory of wind-pressure, and the effect of air in motion upon the sails. The history of the construction and use of windmills is given with a description of the best known. The whole is a very complete treatise, and will probably take its proper place as the standard, the only real treatise upon this subject. It supplies a want, and will probably be extensively read.

The arrangement of the book seems to us excellent, the treatment good, the work, so far as we have been able to check it, accurate, and the conclusions correct. Chapters ii. and ix. on the construction of the formulas for effect, and on the commercial economy of the mill, are the most strikingly valuable parts of the book; and the former will interest the student of the theory of prime movers as greatly as the latter will interest the proposed user of the machine, and the practising engineer. The text is well written, the book-making excellent, and the whole book is an illustration of a kind of work which is always welcomed by the profession to which its author has presented it.

The windmill as a prime mover. By Alfred R. Wolff, M.E., New York. *Wiley*, 1885. 8°.

NOTES AND NEWS.

A large stone slab has just been placed in the wall of the entrance hall of the newly completed portion of the Museum of comparative zoölogy, which was built by Dr. Alexander Agassiz at his own expense, and presented to Harvard college. The simple inscription reads as follows:—

LVDOVICI ▾
AGASSIZ ▾
PATRI ▾ FILIUS ▾
ALEXANDER ▾
MD ▾ CCC ▾ LXXX ▾

— On the last day of August, according to *Nature*, Professor Michel Eugene Chevreul entered upon his 100th year. Apart from the fact, that, among men whose lives have been devoted to active scientific research, no one has before attained such an age, Chevreul stands conspicuous for the vast amount of work he has done, and for the great practical effect his work has had on the industries of the world. When Dumas, in 1852, addressed him on the occasion of handing to him the prize of 12,000 francs accorded to him by the Société d'encouragement pour l'industrie nationale, he said, "Le prix consacre l'opinion de l'Europe sur des travaux servent de modèle à tous les chemistes; c'est par centaines des millions qu'il faudrait nombrer les produits qu'on doit à vos découvertes." More recently, in 1873, when the award of the Albert medal was made by the English society of arts, the terms in which the council expressed the grounds of the award were, "For his chemical researches, especially in reference to saponification, dyeing, agriculture, and natural history, which for more than half a century have exercised a wide influence on the industrial arts of the world." His scientific work, apart from its commercial outcome, was recognized by the Royal society of London as far back as 1826, when he was elected a foreign associate. In 1857 the Copley medal was awarded to him. Other countries have also paid him honor, while the distinctions of his native land have showered upon him. Born in Angers in 1786, where his father was a physician of note, he was but seventeen when he went to Paris to be 'manipulateur' in the laboratory of the celebrated Vanquelin. At the age of twenty he published his first chemical paper, and in the next half-dozen years he had published more than a score on different subjects. Then began that series of papers (commencing in 1813), "Recherches chim-

iques sur plusieurs corps gras, et particulierment sur leurs combinasions avec les alcalis," which extended for many years. In 1824 he was appointed professor of chemistry at the famed factory of Gobelins; and the energy and untiring industry which was one characteristic of his work, soon accumulated stores of knowledge based on experiment. To exact experiment he attached the highest importance. He wrote in 1823, "Experiment is not chemistry, facts alone do not constitute that science; but we cannot have discoveries without exact experiment." His 'Recherches sur la teinture' is an elaborate work; and his 'Moyen de définer et nommer les couleurs' occupies the whole of vol. xxxiii. of the Mémoires of the Institut. It has often been remarked, that it is difficult to believe that the Chevreul of 'corps gras' fame, and the Chevreul who wrote on colors, are one and the same man.

— *Science et Nature* announces the following scientific missions: The naturalist Frédéric Bordas is in charge of a zoölogical expedition to the islands of Mascareignes, Seychelles, and Comores. Clermont-Ganneau has undertaken an epigraphical expedition to the islands of the gulf of Akaba, in the Red Sea. Jacques de Morgan, civil and mining engineer, has gone to study the geology and mineralogy of the Free Orange States, — Transvaal, Zululand, and Natal. Lieut. Palat is exploring the route from Sénégal to Algeria by way of Medina, Timbuctoo, Mabrook, Touat, and Gourara. Benjamin Balansa has charge of a scientific mission to Tonkin, and Jules Borelli is directing an expedition of the same kind at Choa. The intrepid explorer, Serpa Pinto, to whom the Société de géographie granted the gold medal five years ago, is dangerously ill at Hibo, Africa.

— The present year is one of the most successful that the Annisquam summer school of zoölogy has ever seen. Fifteen students have been at work at the tables, all, with one exception, studying the development and anatomy of marine types, and making collections for teaching purposes. The number of states represented is much greater than in any previous year, showing that the reputation of the laboratory is fast spreading. There are students from Massachusetts, Connecticut, New York, Pennsylvania, North Carolina, Tennessee, Indiana, Wisconsin, and Michigan. The laboratory is under the direction of Mr. B. H. Van Vleck, who is himself studying the development of the dog-fish.

— King Oscar II. of Sweden has announced that he will award a prize, on the 21st of January, 1889, the sixtieth anniversary of his birthday, for an important discovery in the field of higher mathematical analysis. The prize will consist of a gold medal having a value of a thousand francs, together with a sum of two thousand five hundred crowns (somewhat less than seven hundred dollars). The commission appointed by the king to determine the conditions of the competition and to judge the papers presented consists of Weierstrass of Berlin, Hermite of Paris, and Mittag-Leffler of Stockholm. They have designated four subjects for competition, the first relating to the motion of a system of particles attracting one another according to Newton's law, the second to a certain class of uniform functions of two variables analogous to hyperelliptic functions, the third to functions defined by differential equations of a certain type, and the fourth to Poincaré's Fuchsian functions. In case none of the memoirs presented on the four subjects named should be deemed worthy of the prize, it may be awarded to a memoir (sent in for competition) containing a complete solution of some other important problem in mechanics or the theory of functions. The exact particulars are set out in a circular letter issued by Professor Mittag-Leffler.

— Circular No. 20 of the division of entomology of the department of agriculture relates to the recently-established branch of economic ornithology, and consists of a statement of the subject to be investigated; namely, the inter-relation of birds and agriculture, and a series of questions calling for information respecting the food-habits of various species of birds, the nature and extent of their depredations, the reason of occurrence of the species, the number of broods raised in a season, the increase or decrease of particular species, etc. The circular, and also directions for the collection of birds' stomachs, will be furnished to all those willing to aid in the work, on application to Dr. C. Hart Merriam, ornithological agent, whose address will be Sing-Sing, N.Y., till Oct. 1; after this date, U. S. department of agriculture, Washington, D.C.

— The latest from Bering Strait brings news of the whaling fleet to July 12. At that date a hundred and ten whales had been taken by seven steamers and twenty-six barks. Three vessels were reported 'clean,' the remainder having from one to nine whales. The usual percentage of disasters are reported. Bark Napoleon, Capt. Smith, was crushed and foundered in lat. 58°, W. long. 177°, about the middle of Bering Sea, on the 5th of May. Her crew took to the boats; and, after a heavy gale four days later, two of these boats were rescued, several men having died of exposure, and the remainder missing, making a total loss of twenty officers and men. Bark Gazelle was stove by a pointed tongue of ice June 3, twenty-five miles south-east from the south-west cape of St. Lawrence Island. The damage was done so quietly that the first intimation had of it was the report of the mate that the hold was full of water. Three hours later she sank; the boats reached the island or other whalers in safety, and were kindly cared for by Capts. Marvin, McGregor and Hayes of the Arnolda, Abram Barker, and Hamilton. The steamer Balaena was badly stove, but was subsequently repaired by the master, and continued her voyage, which bids fair to be a good one, as she was reported with eight whales. The catch is unusually good for the time of the year to which we have reports, and an equal average to Oct. 1 will make a very prosperous season. Whalebone to the value of $150,000 was brought down by the schooner Garfield, mail-carrier and tender to the fleet. Some of the vessels got into the Arctic by the east shore before the whales did, and got nothing; while the vessels south of the strait w· On June 10

the whales began to pass the strait; and on the 19th fifteen were struck by the Balaena and Alliance, of which thirteen were saved.

— The Hydrographic office has just issued a pamphlet (No. 77) entitled 'Practical hints in relation to West-Indian hurricanes,' being a translation by Lieut. Dyer of certain conclusions given by Padre Viñes of Havana, 'Apuntes relativos a los huracanes de las Antillas.' It includes a concise description of the weather preceding a hurricane, laying especial weight on the rise of the barometer, and the consequent anti-cyclonic winds outside of the cyclonic circulation; of the first appearance of the storm-clouds and winds, and the means of determining the bearing of the centre; of the tracks usually followed by these cyclones, and of the best means of escaping them. In speaking of the direction of the wind in the storm, a little fuller statement would seem necessary to avoid danger of being misunderstood. For example, it is said (p. 8), "As a rule, the lower currents converge, forming with the bearing of the storm-centre a variable angle, which is almost always greater than a right angle." By the use of the word 'converge,' the reader at once is led to consider the direction in which the lower winds are blowing spirally around the storm-centre; but, when looking in this direction, the angle between the wind and the storm-radius will be generally *less* than a right angle. Again: the table on p. 9 states, 'If the nimbus clouds and squalls move N., the centre will bear E.,' etc.; this surely ought to be 'move *from* the N.' It is well that the excellent work done by Viñes is thus in part brought before our naval officers; for, although it is some years since his conclusions were translated in Ferrel's 'Meteorological researches for the use of the coast pilot' in the coast-survey reports, we fear that some of our lieutenants have failed to read them.

— Among recent deaths we note the following: Professor Fleming Jenkin of the University of Edinburgh, June 12, in his fifty-third year; George Witz, chemist, at Rouen, June 17, in his forty-ninth year; Prof. A. W. Eklund, at Lund, Sweden, in his ninety-first year; and Dr. T. Clausen of the Dorpat observatory, May 25, in his eighty-fifth year.

— Prof. John Le Conte of California prints in the *Overland monthly* for August, 1885, an excellent argument in favor of the employment of the metric system.

— *The museum*, formerly published at Philadelphia, has been merged with the *American antiquarian*, published at Clinton, Wis. *The young mineralogist and antiquarian* has been suspended.

— The title of Rieger and Tippel's pamphlet (Experimentelle untersuchungen über die willensthätigkeit. Jena, *Fischer*, 1885. 48 p. 8°) is rather too pretentious for its content. The activity of the will, studied by the authors, is the holding out of the hand, as steadily as possible, for two minutes. The hand is found to waver slightly, and usually to sink somewhat without the subject becoming aware of the change. Dr. Rieger described his method of tracing its motions in his former book on hypnotism. The patient holds a pin between his fingers. The pin's shadow is cast on the drum of a chronograph, where some one keeps a pencil-point upon its head whilst the drum revolves. Nine plates give specimens of the many curves thus obtained. Either phlegmatic stolidity, or normal strength of will, makes them level and regular. Hysteric mobility makes them irregular. Dementia may make the line sink very rapidly. In certain states of cerebral irritation with tendency to contraction of the flexors, the line rises instead of sinking. Tremor and hemiplegia give vibrating curves. The administration of amylnitrite acts differently in different persons. Usually, however, it makes the curve worse. This is especially the case in delirium tremens. Many a mickle makes a muckle; and, out of such small facts as these, something worth knowing about voluntary activity may some day be inferred. What Dr. Tippel has to say of the influence of amylnitrite on the brain-circulation, will be found worth reading by those whom it concerns.

— It is rare, indeed, that a scientific article prepared nearly forty years before, and familiar by copious extracts, merits publication in full as still the best work in its own special field. Yet few will contest that such is the case with Mr. Aubin's celebrated essay on "La peinture didactique et l'écriture figurative des anciens Mexicains." All students of the subject are familiar with the remarkable results which he reached; but the full evidence of his statements, his proofs, in other words, that the Aztec hieroglyphic writing is, in a measure, phonetic, has never been submitted. In spite of the productive labors in the same field of the late Señor Ramirez, we find, in several of the most recent authoritative works on Mexico, the phonetic character of the ancient writing wholly denied. Now, however, the French government has published Mr. Aubin's essay complete, revised by the venerable author himself, and edited by the competent conservator of the museum of the Trocadéro, Dr. Hamy. Five beautifully executed chromo-lithographic reproductions of Mexican codices accompany the essay, and serve as undeniable testimony to the accuracy of the author's rendering of the text, as they contain a translation in Nahuatl of the figures. It cannot be said that the publication develops the theory to any further extent than did the original article in 1849; but the evidence on which it rests is for the first time submitted in a form satisfactory to students. The publication is one of the issues of the "Mission scientifique au Mexique et dans l'Amérique Centrale."

— Bulletin No. 1, new series, of the New-York agricultural experiment station, contains an analysis and valuation of 'Mason's high-grade potash fertilizer,' manufactured in Binghampton, N.Y., showing it to be an unmitigated swindle; a ton of it being worth, according to the station's liberal estimates, about a dollar and a half, while the selling-price is thirty dollars. The reprint of the manufacturer's circular, which makes part of the bulletin, is one of the best specimens of pseudo-science which it has lately been our fortune to meet.

SCIENCE.

FRIDAY, SEPTEMBER 25, 1885.

COMMENT AND CRITICISM.

HE NEWS-REPORTERS of the daily press are g to enliven the dull season by the inven- of stories of fraud and irregularities in various scientific bureaus of the govern- t. Now it is a new find in the accounts he coast-survey, and now it is a start- report upon the proceedings of the fish- mission, or the work of the national eum. These stories have the appearance eing earnest endeavors to guess out things h, from the point of view of the news- rter, might possibly be true, made by men do not know enough about the case to e their guesses even plausible. Last week Boston *Advertiser* published a despatch Washington, purporting to give an ract of a report on the operations of the ogical survey. The despatch might have sed muster but for an unfortunate endeavor he reporter to strike beyond his reach, by ng that Professors Cope and Marsh had allowed to appropriate collections of the e of $150,000, belonging to the survey. he known that Cope never had any con- ion with the survey, and so had never had pportunity to possess himself of its speci- s, the inventor would, no doubt, have sub- ted some other name for his. That a board xperts would accuse the director of the body museum of Yale college of unlaw- possessing himself of specimens handed im for examination and report, is a state- t fitted only to provoke a smile. The fact the director of the survey had just left a month's tour of inspection in the far t, rendered almost unnecessary the denial he auditor that such a report existed.

When the history of the irregularities in the t-survey is calmly reviewed, it will, no doubt, be found that the interests of the government have suffered less than one would suppose from the flaming head-lines which introduced the treasury report on the subject. If, as is said to be the case, the work unlawfully paid for was all done outside of office hours, and in addition to the regular duties, the case may admit of some palliation from a moral aspect, even though we deplore such a departure from the spirit of the wise and necessary law that salaried government employees shall not receive extra pay for real or supposed extra work. The country will not see any great wrong in loaning antiquated transit instruments to institutions of learning, when they no longer serve the purposes of the survey. The disposition to show a newly discovered evil in the strongest light, and to omit palliating circumstances, is common to all men, committees of investigation included. Let us, then, reserve our judgment until we have heard and weighed the other side.

THE PUBLICATION of his third report on the insects of Illinois furnishes the state entomologist, Dr. S. A. Forbes, an opportunity to prepare an index to the first twelve reports, which is done in excellent manner, and to call attention to the fact, that, in volume, the fourteen reports of the entomologists of Illinois, amounting in all to 2,358 pages, exceed the literature of economic entomology of any other state. Commenced by Walsh, who died soon after his appointment, and continued by LeBaron and Thomas, the office has now fallen into better hands than at any time since its foundation, the reports of Mr. Forbes having already become a standard by reason of the independent and original methods with which he is pursuing the study of economic entomology. The three reports which he has now published, equal in value the larger bulk of their predecessors.

LETTERS TO THE EDITOR.

Recent volcanic activity in the United States: eruptions of Mount Baker.

In a late communication to *Science* from Capt. Dutton of the U. S. geological survey, he mentions the date 1850 as that of the latest volcanic eruption within the limits of the United States. This must necessarily exclude Alaska. He also refers to vague reports of volcanic activity at later dates.

In adding a mite to the subject of his paper, I would ask your permission to recall three instances of volcanic activity on this coast, leaving open the question, What is the exact line between the smouldering of the 'living' volcanoes, and those which are 'active,' or in 'eruption'? etc.

1°. In 1854 I was one day observing at the trigonometrical station on Obstruction Island in the Rosario Strait, Washington Sound: I had finished the measures for horizontal direction of the summit of Mount Baker, and was commencing a series of measures of the vertical angles for elevation, when I found the whole summit of the mountain suddenly obscured by vast rolling masses of dense smoke, which in a few minutes reached an estimated height of two thousand feet above the mountain, and soon enveloped the higher parts. Baker was distant thirty-nine geographical miles from my station, and bore about north seventy-five degrees east, true. The weather was fine, and we hoped to see a brilliant display at night; but unfortunately the sky clouded, and we could not see the light at night, nor the mountain next day: when the weather cleared, the eruption had ceased; and, instead of the white mountain mass, we discovered that the snow covering it was apparently melted away for two or three thousand feet below the two heads. Of course the snow may not have been melted, but only covered with ashes and scoriae; and we had not the means of deciding the question at that distance.

We had been in those waters during parts of 1852 and 1853, and then the snow-clad mountain was quiet.

We discovered that the crater was not on the summit, or on the secondary peak to the south-eastward, but on the flank of the higher peak, and opening towards the south or south-west. In subsequent years we occasionally saw small volumes of smoke issuing from this crater. The facts of this eruption were reported by me at the time.

2°. In 1858 Mr. John S. Hittell of San Francisco was in Victoria, and he informs me that the night clouds over Mount Baker were brilliantly illuminated by the light from an eruption of Mount Baker. Upon his making inquiries among the citizens of Victoria, they expressed themselves as being well aware of the eruption then going on.

3°. I left these waters at the close of the season of 1857; but my colleague, Capt. James S. Lawson, who succeeded me in that section, says there was no eruption for the years he observed in the Gulf of Georgia. In 1867 and in 1869 I passed through the waters of Washington Sound and the Gulf of Georgia, and returned, all in sight of Mount Baker; but there was nothing unusual in the appearance of the mountain. In 1870, when I was passing through Admiralty Inlet and the Strait of Fuca, towards Victoria, Mount Baker was very clearly in sight at about sixty miles distance, when I beheld great volumes of smoke projected from the crater to an estimated height of eight hundred feet above the higher peak. During my stay at Victoria in September, with Mount Baker distant seventy-three and three-quarter geographical miles, and bearing north seventy degrees east, true, from Rocky Hill, I made observations for the height of the two peaks, the position and size of the crater, and the height of the snow-line. I made also an accurate drawing of the outline of the mountain and its surroundings, the more particularly because rumors had found their way into the newspapers, asserting that the summit of Mount Baker had fallen in. On the contrary, I was perfectly satisfied, from my years of familiarity with its features, that no such catastrophe had taken place between 1852 and 1870; nor was I able to detect any changes in 1877, when I was daily in sight of Mount Baker for some time.

I should call attention to the fact, that, a good many years since, Mr. E. T. Coleman of Victoria (if I remember his name properly), after two unsuccessful attempts in two different seasons, was the first alpine climber who made the ascent of Mount Baker. He published his account thereof, with illustrations of the glaciers, névé, etc., in *Harper's magazine*; but I cannot recall the date. I add the following data, which were incidentally obtained in different years by Capt. Lawson and myself when engaged in regular coast-survey duty:—

The geographical position of the higher and main peak of Mount Baker is, latitude, 48° 46′ 34″ north; longitude, 121° 50′ 4″ west. The height is 10,755 feet above the sea level; the height of the second peak, which lies probably two miles towards the south-east, is 10,163 feet; the upper part of the crater is 596 feet below the summit of the mountain; and the length of the crater about 400 feet. The crater appears to be four times as long as it is broad; the narrowest part is the upper limit; and it lies on the southern slope of the main peak, and parallel with the slope, which I judged to be thirty degrees with the horizon. The lowest limit of the snow-line in September, 1870, at the close of the summer dry season, was 5,301 feet above the sea.

These observations were made with a small instrument at a long distance; but my height of the principal peak differed only seventy-two feet from the mean of previous observations, and I believe they are trustworthy.

GEORGE DAVIDSON.

Davidson observatory, San Francisco, Cal., Sept. 1.

Linguistic studies at the Siletz agency.

In the abstract of my first paper read in Section H, A.A.A.S., as published on p. 230 of *Science* for Sept. 11, a slight mistake was made. For 'three sets of cardinal numbers, human, inhuman, and inanimate,' read 'two sets of cardinal numbers, the human, and the non-human series.'

J. OWEN DORSEY.

Washington, D.C., Sept. 19.

Spectrum of the great nebula in Andromeda.

By employing the eye fresh from some hours' sleep, by looking for some time in the spectroscope, and by

giving the spectrum a slight apparent to-and-fro motion, I have been enabled, independently, upon Sept. 5, 7, 9, 12, 21, to discern three bright lines superposed upon the continuous spectrum of the nebula in An-

dromeda. The relative positions are shown in the adjoining cut.

The 'lines' at 18.6 and 19 appear, using the broad slit, as bright knots. That at 17.5 as a long line. The arrangement of the lines suggests certain bright lines in the spectrum of γ Casseopeiae and β Lyrae, and the settings agree with those made upon the spectrum of the said stars.

O. T. S.

Yale college observatory,
Sept 14.

The Mexican axolotl and its susceptibility to transformations.

Marie von Chauvin's experiments with the axolotl, as recounted in *Science* No. 130, under the above title, interested me very much indeed, inasmuch as they came upon me at a time when I was experimenting with upwards of two hundred of these animals by very similar methods.

My present field of research is in north-western New Mexico, and several forms of axolotls are to be found in the region. Last June (1885) I visited, near my present residence, on more occasions than one, a small pond that contained large numbers of them. This pond is nearly square, and its sides something over a hundred feet in length. It is divided in two nearly equal parts by an east and west embankment. This embankment has a narrow trench cut through it, so that when the rain fills the ponds they communicate with each other; but this is not the case when the water is low.

By the 1st of September each year these ponds are usually dried up; while during the spring and summer months, the south one has a mid-depth ranging between three and six feet, and the north one being considerably shallower. These depths vary with the amount of rainfall, and other meteorological conditions.

As I say, there were great numbers of axolotls in these ponds; and as far as I could see, and by the very kind assistance of Professor Cope, these were of two kinds: one very large one (20 cms $\pm$) seemed to be the larval form of Ablystoma mavortium; another much smaller one (9 cms $\pm$) proves to be A. tigrinum. In addition to these, there are some medium-sized ones that are very puzzling, and not yet satisfactorily diagnosed. With but few exceptions, the north division of the pond contained the small ones; while in the other side lived all the large ones, together with the great majority of the light-colored and undetermined forms.

The limits of this paper will not permit me to present all the conditions of environment under which these axolotls live, much less an account of the many observations I made upon their habits as they are to be seen in a state of nature. At different times I captured as many of these creatures as I desired, to carry on my experiments at home, the results of which I had the unusual opportunity of comparing with those changes undergone by these reptiles while existing in their natural element.

It is my sole aim in this paper to briefly present the results of some of these experiments, so far as they have gone, and compare them with those arrived at by Miss von Chauvin, as set forth in *Science*.

My observations confirm those of this talented authoress, in that, —

1. Axolotls are more readily converted into Amblystomas if kept in water containing but little air, and *vice versa*.

2. If transformation is forced up to a certain point in development, the reptile arrives at the higher form without any further interference.

3. Axolotls live in the water with apparent comfort a considerable and varying length of time after their gills have been absorbed.

4. After the metamorphosis is completed, their power to return to the water again to live, seems to depend upon the moult, and whether they have lived in moist or dry places since the metamorphosis.

5. By varying the conditions under which these animals live, we can at our pleasure retard or accelerate their development to the higher stages.

6. Young axolotls are more easily transformed than the older specimens, but this rule also depends largely upon the conditions under which these animals live.

There is another very important factor that enters into this metamorphosis, that, so far as the account in *Science* goes, is not touched upon; and that is, the question of their diet during the experiments. Axolotls are very voracious creatures, and eminently carnivorous. They are very fond of raw meat; and, upon the slightest provocation, they will feed upon each other. So I have found, during the course of my experiments, that, —

7. The metamorphosis is hastened by regularly supplying the animals with plenty of proper food. And what is still more interesting, when they are thus treated, it markedly affects the appearance of the transformed Amblystoma.

8. If, during the process of forcing the transformation of axolotls, the animals are regularly supplied with the requisite amount of fresh meat, the transformed Amblystomas are very much larger and stronger than those which are transformed without having received any food. In the case of A. tigrinum, those that received food, the transformed animal would hardly have been recognized as the same species: they were not only larger, but of a very deep, muddy, *black* color, without spots; while the others were mottled with bright yellow, and a pale brown.

9. The *depth* of the water has a wonderful influence upon the metamorphosis; and the fact is well known, that, the deeper the water in which the axolotls live, the slower their transformation.

Temperature is another important factor in the change, and its moderate increase seems to hasten the transformation.

Now, the most interesting part of all is to watch the operation of these laws, that I have given, in nature, and the manner in which the metamorphosis of axolotls is there effected.

It would, indeed, be hard to find anywhere a more perfect and beautiful example illustrating the extremely sensitive balance that may exist between the surrounding conditions on the one hand, and their effect upon an animal organism on the other. This year, for instance, the very pond that I have alluded to above, gradually dried up; the north half of it entirely. This took a number of weeks; but during that time *all* the modifications of which the metamorphoses of axolotls are subject to, or capable of, were, so far as their necessity goes, most lucidly demonstrated. A shallow corner in this pond would, after a torrid day or two, dry up; whereupon all the axolotls that happened to be caught within its limits, would be found, perhaps several hundred of them, under the *débris*, rapidly assuming the Amblystoma form. Numbers of the same generation, however, in the deeper parts, would be unaffected by the change of environment so suddenly precipitated upon their brethren. If the drying-up continued, these trans-

formed animals quit the site, and, during the next few days, could be found under logs, and in other suitable places at some considerable distance from it. On the contrary, should a rain in the mean time fill the pond again, and flood over these shallow parts, the transformations were checked; and those with gills and branchiae in all stages of change, once more took to the water. When huddled together in the shallow places, the large and strong ones devoured the smaller and feebler forms; and the different appearance of the two was very striking upon the most superficial examination.

One day in July the whole north half of this pond suddenly ran dry; and I must confess the sight its bottom presented during the following day was one of the most extraordinary, and at the same time most interesting, that I ever beheld, and, after what has been said, can be better imagined than described. It absolutely swarmed with these creatures, whose organizations were accommodating themselves to the new condition of affairs as rapidly as the laws governing the changes permitted. The study would have furnished food for a small volume.

Axolotls are also affected by the character of the ponds or swamps they live in, the same species showing all manner of shades in their coloration. Those in shallow ponds with little or no vegetation, and hard clay bottoms, grow to be very light colored, and long retain their larval forms.

No doubt many such ponds as I have described exist all over this south-western country; and a moment's reflection will make it clear to us how the metamorphosis of this creature tends to save thousands of their lives, when the region is visited by a protracted drought, and their places of water resort fail them. The preservation of the form is thereby, to a great extent, protected.

DR. R. W. SHUFELDT.

Fort Wingate, N. Mex.,
Aug. 12.

THE SONG-NOTES OF THE PERIODICAL CICADA.

THERE are few more interesting subjects of study than the notes of insects and the different mechanisms by which they are produced. They interest every observant entomologist; and it is difficult to record them in musical symbols that can be reproduced on musical instruments, some of the more successful and interesting attempts in this direction having been made by Mr. S. H. Scudder. I have studied closely the notes of a number of species, and have published some of the observations.[1]

In the notes of the true stridulators more particularly, as the common tree-crickets and katydids, I have been impressed with the variation both in the pitch and in the character of the note, dependent on the age of the specimen, and the condition of the atmosphere, whether as to moisture, density, or temperature. Yet, with similarity in these conditions, the note of the same species will be constant and easily recognizable.

A few remarks upon Cicada septendecim will doubtless prove of interest now that the species has been occupying so much attention. I do not find that the notes have been anywhere very carefully described in detail, nor would I pretend to put them to musical scale. Writing seventeen years ago, I described the notes in a general way, as follows: —

"The general noise, on approaching the infested woods, is a compromise between that of a distant threshing-machine and a distant frog-pond. That which they make when disturbed mimics a nest of young snakes or young birds under similar circumstances, — a sort of scream. They can also produce a chirp somewhat like that of a cricket, and a very loud, shrill screech, prolonged for fifteen or twenty seconds, and gradually increasing in force, and then decreasing."[1]

There are three prevalent notes, which, in their blending, go to make the general noise as described above. These are, —

First, That ordinarily known as the *phar-r-r-r-aoh* note. This is the note most often heard during the early maturity of the male, and especially from isolated males or from limited numbers. It is variable in pitch and volume, according to the conditions just mentioned as generally affecting insect melodists. Its duration averages from two to three seconds; and the *aoh* termination is a rather mournful lowering of the general pitch, and is also somewhat variable in pitch, distinctness, and duration. In a very clear atmosphere, and at certain distances, an individual note has often recalled that made at a distance by the whistling of a rapid train passing under a short tunnel. But when heard in sufficient proximity, the rolling nature of the note will undoubtedly remind most persons more of the croaking of certain frogs than of any thing else. I have heard it so soft and low, and so void of the *aoh* termination, that it was the counterpart of that made by Oecanthus latipennis Riley late in autumn, and when shortened from age and debility of the stridulator.

Second, The loudest note, and the one which is undoubtedly most identified with the species in the popular mind, is what may be called the 'screech.' This is the note described by Fitch as "represented by the letters *tsh-e-e-E-E-E-E-E-e-ou*, uttered continuously, and prolonged to a quarter or half a minute in length, the middle of the note being deafeningly shrill, loud and piercing to the ear, and its termination gradually lowered till the sound

[1] 3d rep. ins. Mo., 14, 153, 154; 4th do., 139; 6th do., 150–169.

[1] 1st rep. ins. Mo., 24.

expires." Dr. Fitch errs as to the length of its duration; and I have also erred in the same direction — unless, indeed, there is a still greater range than my subsequent observations would indicate.[1] It is more probable, however, that our memories were at fault; for, as I have verified this year, this shrilling ordinarily lasts from two to three seconds, though occasionally longer, and is repeated at intervals of every five seconds. This note is rarely made by solitary males, or when but few are gathered together: but it is the prevailing note in the height of the season, and is made in unison; i.e., the assembled males on a given tree, or within a given grove, are prompted to it simultaneously, so that its intensity becomes almost deafening at times. It is of the same nature as that made by the dog-day Cicada (Cicada pruinosa Say), and in its higher and louder soundings is not unlike the shrilling of that species, though by no means so sharp and continuous. It is what in the distance gives the threshing-machine sound, and it has often recalled what I have heard in a saw-mill when a log is being cut crosswise by a circular saw.

Third, There is what may be called the intermittent, chirping sound, which consists of a series of from fifteen to thirty, but usually about twenty-two, sharp notes, sometimes double, lasting in the aggregate about five seconds. This sound is so much like that ordinarily produced by the barn or chimney swallow (Hirundo erythrogaster), that a description of the one would answer fairly well for both. It resembles also, though clearer and of higher pitch, the note of Microcentrum retinerve Burm., which I have likened to the slow turning of a child's wooden rattle highly pitched. The above notes, so far as I have recognized them, are of higher pitch, but of less volume, in the smaller, Cassinii, form.

The other notes — viz., that made when the insect is disturbed, and a not infrequent short cry, that may be likened to that of a chick — are comparatively unimportant: but no one could do justice to the notes of this insect without embracing the three peculiar sounds which I have attempted to describe above, and which are commingled in the woods where the species is at all common; though the undulatory screech is by far the most intense, and most likely to be remembered.

C. V. RILEY.

[1] Since this was written, I have heard, on two occasions, this note prolonged to twenty seconds; but this is quite abnormal, and I have no other evidence than the season (June 20) to prove that it came from C. septendecim.

LOST RIVERS.

THE phenomenon of a stream flowing merrily down from a mountain and then disappearing, is, in the west, a very common one. In following down the Rio Grande on an enlarged map, we find many streams entering into it in its upper course. In going down a little farther, reaching the San Luis valley, they are found to suddenly give out on the northern side; and, a few miles farther down, on the southern side also. The principal streams of the valley, the Rio Grande excepted, come in full force down the mountain, flow freely on, and terminate in a marsh, or a small lake, or in the sand. The beds of those which should empty into the Rio Grande are there, but there is no water in them. Similar streams are common over the south-west; and the various streams show all the different stages, from those which really go somewhere all the time, to those which empty into their main stream a part of the time, and those which, alive and full of water above, always fail to reach the stream to which they are headed below.

One time I had the curiosity to examine a stream at the point where it was lost. It was the Rio Hondo, just south of Santa Fé. We had crossed it lower down; and, though the ravine was seventy-five or a hundred feet deep, we had found it perfectly dry. We followed up its south bank for a mile or two until we struck the foot-hills, and there we found it a bright, rippling stream, leaping down from ledge to ledge, very picturesque, with some scattered trees along the banks, and so broad that it was not easy to pass over it, leaping from stone to stone, and remain dry-shod. From here my friend drove back to the crossing, and I walked down to see where and how a stream could lose itself with such a volume of water, and a path well marked out for it. As I followed it down, it ran on merrily in the midst of a little valley not more than six or eight rods wide, along which were pretty meadows alternating with clumps of bushes. It passed through the various incidents of a stream, — here a little fall, there a rapid over thickly set stones, a little farther on a pool. There seemed to be nothing unusual in it, when suddenly I noticed that the little valley widened to double its previous width, the bed became more sandy, and the stream was spread over a greater space. It was evidently going under; and, within twenty rods of where I noticed the first change, the running water had entirely disappeared. The bed of the stream was damp

for twenty rods or so more; then for a considerable distance I could get water by digging a few inches; then that indication failed, and beyond the stream-bed was entirely dry.

Not all such streams terminate thus in the middle of their bed: some terminate in a small shallow lake, some in a marsh; and either lake or marsh is pretty sure to be brackish, due to constant concentration by evaporation of the alkalies held in solution. Other lost streams fill up after a rainfall, and complete above the ground their course to the main stream. After a heavy rain in the mountains they are apt to change their 'lost' character with a suddenness and decision which may prove dangerous. The water occasionally pours down with an advancing wave or head, which is described as sometimes five or six feet high.

There is one remarkable case in New Mexico where the lost tributaries are plentiful, but the main stream does not exist. This is in a valley which lies between the Rio Grande and the Pecos River. The valley begins near the Sandia Mountains, and is shut out from the streams on each side by broken mountain-chains. It is a well-defined valley, not very broad, but having a length of perhaps three hundred miles. It is somewhat obscured by the small scale, and inaccuracies, of the smaller maps; but on a larger and correct map of the territory its valley-character is unmistakable. It lies much nearer the Rio Grande than the Pecos. Flowing into it, especially on the western side near the upper end, and on the eastern toward the lower, are numerous lost tributaries; but the primary stream has so completely disappeared that its bed can only be found at intervals.

In this valley lie the ruins of the Gran Quivira, the existence of which is not only attested by the ruins themselves, but also by the accounts of the earliest Spanish travellers. The records of the Spanish up to the latter part of the seventeenth century, when they were expelled by the Indians, are incomplete, as the Indians destroyed all that was left behind. That the Gran Quivira was well known to them, however, is shown by the fact that the most prominent ruin there is that of a church. There is now no water for many miles from the ruins. That there must have been once, can well be granted; for no large city would have been built by human beings at a distance of fifteen or twenty miles from a scanty water-supply. The valley may be named from this city, and would then be the Gran Quivira valley.

About half-way down the valley it is broken by a long, narrow, thin layer of lava, now much broken up, and making a desolate region, locally known as the Mal-pais, or 'bad land.' The crater from which the lava was derived was near the northern end of the Mal-pais. Just above the Mal-pais an old river-bed is reached at the depth of about two hundred and fifty feet: below it, the river-bed, when found, is at a slight depth. South-west of the Apache reservation the old river-bed runs into a large salt-marsh.

A stream of no mean size seems to have once run down this valley. Not only has it now disappeared, but its bed is covered by lava and loose soil sometimes to great depths. As to the cause of the disappearance, it may have some connection with a tradition of the Indians which tells of a year of fire, when this valley was so filled with flames and poisonous gases as to be made uninhabitable. When this occurred, the chronology of the Indians is not perfect enough to tell us. That it was long ago, is attested by the depth to which the old bed is covered by detritus, probably washed down from the mountains, and by trees of considerable size which are found in some places in it. But that it was not so extremely long ago that it had become entirely uninhabitable, is made probable by the comparatively late desertion of the Gran Quivira. It is entirely possible that the Indian year of fire may have long preceded the drying-up of the part of the valley in which Gran Quivira was situated.

M. W. Harrington.

ZUÑIAN CONCEPTIONS OF ANIMAL FORMS AS SHOWN IN POTTERY.

Several months ago I visited the Pueblo of the Zuñis, and while there enjoyed the opportunity of watching a group of five or six Zuñi women painting some of their pottery.

To show the degree of merit of the Zuñis in their copies of animal forms, one needs no better illustration than their attempts to reproduce the figure of the owl. It is probable that the species of this bird they have used as their model, from time immemorial, is Bubo virginianus, the great American horned owl. All the Zuñian clay effigies of owls have horns on their heads; and Bubo virginianus is not only the most common owl in the region, but the only one that is thus conspicuously tufted, being characterized by a prominent pair of feather-horns.

My drawing (fig. 1) represents a side view of an adult specimen of the owl in question, with its mandibles intentionally opened, in order to be as much like the Zuñi model (fig. 2) as possible.

This clay copy is the most faithful one I could obtain from a large stock of such material, and one of the best of their attempts in this direction that I have ever met with, or seen figured.

It will be seen that the modeller has represented the tufts upon the head of his subject by a pair of conical elevations. The clay used to make this figure is susceptible of being formed into much more natural-looking tufts than these, yet we never find them. In common with the beak, they are painted a brownish red, in sharp contrast with the white body of the rest of the model. An attempt is always made to represent the feather disk about the eye. Sometimes this is done by two plane concentric circles; other artists make it as shown in fig. 2; and still others have the radiating lines without the limiting-circle. The beak in my specimen is one of the best efforts of the kind that has come under my observation, an attempt evidently having been made to represent its raptorial type. This is not always the case, as may be seen from examining the admirable figures of these models, presented us in Powell's 'Second annual report,' and illustrating Mr. Stevenson's unrivalled collections of 1879.

FIG. 1.—Right lateral view of head of adult specimen of Bubo virginianus; reduced about ½.

The body and wings of one of these effigies of the owl come much nearer in form to the body and wings of a young specimen of Bubo, say two or three weeks old, than they resemble these parts in the adult owl; the former being short and rounded, and sometimes represented with a tail, and sometimes without. This may have been influenced, originally, from the fact that these young owls are often taken; but they do not acquire the feather-horns until later in life.

We find the talons represented by five characterless points, sometimes radiating as a star, and sometimes arranged with three in front, and one behind, which is better; though these parts never suggest to us the raptorial foot of the owl.

In criticising one of these Zuñi effigies, we must bear in mind the fact of the great tendency, as in many of the Spanish-American folk, to imitate the work of their ancestors;

FIG. 2.—Three-quartering view from the right of a Zuñi model of the head of an owl; reduced about ½.

and it would be hard to say for how many generations this clay model of the Zuñian owl has passed down without the slightest attempt at improvement in the direction of a more faithful portraiture of nature. Occasionally, however, an artist will make a lucky hit; and I have two ducks in my possession that illustrate this. The larger and adult one evidently intended to represent a widgeon (Mareca Americana); and its likeness, both in coloration and form, is at once quite striking. The other specimen is a young duck of some nondescript variety, the merit of which lies in the rather faithful imitation of the duckling as distinguished from an old bird. This is independent of its size, and, I expect, a difficult effect to successfully produce with the materials at their command, and rarely accomplished.

Their pottery illuminations of birds, as works of art, are no better than could be done by any of our children at eight or nine years of age. Occasionally we find one where the family can be guessed at, but more often the very order is obscure.

Mr. Cushing tells us, in one of his classical contributions to *Century magazine* (May, 1883), about Zuñi, the veneration these people have for the turtle, and how they seem to believe it harbors the soul of some one of their dead, or, as he expresses it, 'our lost others.'

We would naturally expect, therefore, to find

their models of turtles among the best of their clay sculptures. Nor are we disappointed in this, as may be judged from the two drawings (figs. 3 and 4) from a specimen of this kind in my possession.

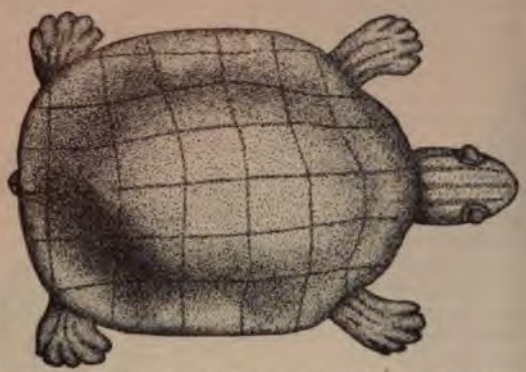


Fig. 3.—Dorsal view of turtle modelled in white clay by Zuñi Indian.

The carapace of this figure is painted a deep brown; while the epidermal plates are simply indicated by six transverse lines, crossed by the same number of longitudinal ones, both in a flesh-red color. This latter tint has also been used to paint the plastron and longitudinal lines on the deep-brown head and feet. This coloration gives it a not distant resemblance to some form of Chrysemys. Two such specimens are in my collection; and in both the designer has represented the toes by simply slitting the clay a little ways, in one instance correctly, as seen in the figure; and in the other by three slits, giving each foot only four toes.

Fig. 4.—The same, lateral aspect. Both less than half the size of original.

I have never seen the turtle depicted upon any of their pottery, and I believe it must be one of their rarer forms to model in clay. So far as I can remember, Mr. Barber does not mention it, or figure the turtle in his article in the *American naturalist*, published some four years ago; nor does Mr. Stevenson allude to it, by word or figure, in the catalogue of his enormous collection of 1879 already quoted.

Mr. Stevenson's figures support another curious fact which I have observed, and will allude to before concluding. It is this: they seem to reserve their amblystomas, their axolotls, their tadpoles, and their bugaboos of human form, to illuminate the quaint clay baskets they manufacture, which usually have handles, and are ornamented with fancy serrated edges, and are of odd shapes. Almost invariably they represent the tadpoles upon side view, and take especial pains to draw the suctorial lips and the eye. The tail, however, is drawn simply by a wriggling line, and is not the broad tail of the tadpole, seen upon lateral aspect of this creature. R. W. Shufeldt.

TYPES AND THEIR INHERITANCE.

The object of the anthropologist is plain. He seeks to learn what mankind really are in body and mind, how they came to be what they are, and whither their races are tending; but the methods by which this definite inquiry has to be pursued are extremely diverse. Those of the geologist, the antiquarian, the jurist, the historian, the philologist, the traveller, the artist, and the statistician, are all employed; and the science of man progresses through the help of specialists. Under these circumstances, I think it best to follow an example occasionally set by presidents of sections, by giving a lecture rather than an address, selecting for my subject one that has long been my favorite pursuit, on which I have been working with fresh data during many recent months, and about which I have something new to say.

My data were the family records intrusted to me by persons living in all parts of the country; and I am now glad to think that the publication of some first-fruits of their analysis will show to many careful and intelligent correspondents that their painstaking has not been thrown away. I shall refer to only a part of the work already completed, which in due time will be published; and must be satisfied if, when I have finished this address, some few ideas that lie at the root of heredity shall have been clearly apprehended, and their wide bearings more or less distinctly perceived. I am the more desirous of speaking on heredity, because, judging from private conversations and inquiries that are often put to me, the popular views of what may be expected from inheritance seem neither clear nor just.

The subject of my remarks will be 'Types and their inheritance.' I shall discuss the conditions of the stability and instability of types, and hope, in doing so, to place beyond doubt the existence of a simple and far-reaching law that governs hereditary transmission, and to which I once before ventured to draw

Opening address before the section of anthropology of the British association for the advancement of science, by Francis Galton, F. R. S., etc., president of the section. From advance sheets of *Nature*.

attention on far more slender evidence than I now possess.

It is some years since I made an extensive series of experiments on the produce of seeds of different size, but of the same species. They yielded results that seemed very noteworthy; and I used them as the basis of a lecture before the Royal institution on Feb. 9, 1877. It appeared from these experiments that the offspring did *not* tend to resemble their parent seeds in size, but to be always more mediocre than they, — to be smaller than the parents, if the parents were large; to be larger than the parents, if the parents were very small. The point of convergence was considerably below the average size of the seeds contained in the large bagful I bought at a nursery-garden, out of which I selected those that were sown.

The experiments showed, further, that the mean filial regression towards mediocrity was directly proportional to the parental deviation from it. This curious result was based on so many plantings, conducted for me by friends living in various parts of the country, — from Nairn in the north, to Cornwall in the south, during one, two, or even three generations of the plants, — that I could entertain no doubt of the truth of my conclusions. The exact ratio of regression remained a little doubtful, owing to variable influences; therefore I did not attempt to define it. After the lecture had been published, it occurred to me that the grounds of my misgivings might be urged as objections to the general conclusions. I did not think them of moment; but as the inquiry had been surrounded with many small difficulties and matters of detail, it would be scarcely possible to give a brief, and yet a full and adequate, answer to such objections. Also, I was then blind to what I now perceive to be the simple explanation of the phenomenon; so I thought it better to say no more upon the subject until I should obtain independent evidence. It was anthropological evidence that I desired, caring only for the seeds as means of throwing light on heredity in man. I tried in vain for a long and weary time to obtain it in sufficient abundance; and my failure was a cogent motive, together with others, in inducing me to make an offer of prizes for family records, which was largely responded to, and furnished me last year with what I wanted. I especially guarded myself against making any allusion to this particular inquiry in my prospectus, lest a bias should be given to the returns. I now can securely contemplate the possibility of the records of height having been frequently drawn up in a careless fashion, because no amount of unbiassed inaccuracy can account for the results, contrasted in their values, but concurrent in their significance, that are derived from comparisons between different groups of the returns.

An analysis of the records fully confirms, and goes far beyond, the conclusions I obtained from the seeds. It gives the numerical value of the regression towards mediocrity as from 1 to ⅔, with unexpected coherence and precision; and it supplies me with the class of facts I wanted to investigate, — the degrees of family likeness in different degrees of kinship, and the steps through which special family peculiarities become merged into the typical characteristics of the race at large.

The subject of the inquiry on which I am about to speak was hereditary stature. My data consisted of the heights of 930 adult children, and of their respective parentages, 205 in number. In every case I transmuted the female statures to their corresponding male equivalents, and used them in their transmuted form; so that no objection, grounded on the sexual difference of stature, need be raised when I speak of averages. The factor I used was 1.08, which is equivalent to adding a little less than one-twelfth to each female height. It differs a very little from the factors employed by other anthropologists, who, moreover, differ a trifle between themselves: anyhow it suits my data better than 1.07 or 1.09. The final result is not of a kind to be affected by these minute details; for it happened, that, owing to a mistaken direction, the computer to whom I first intrusted the figures used a somewhat different factor, yet the result came out closely the same.

I shall explain with fulness why I chose stature for the subject of inquiry, because the peculiarities and points to be attended to in the investigation will manifest themselves best by doing so. Many of its advantages are obvious enough, such as the ease and frequency with which its measurement is made, its practical constancy during thirty-five years of middle life, its small dependence on differences of bringing up, and its inconsiderable influence on the rate of mortality. Other advantages which are not equally obvious are no less great. One of these lies in the fact that stature is not a simple element, but a sum of the accumulated lengths or thicknesses of more than a hundred bodily parts, each so distinct from the rest as to have earned a name by which it can be specified. The list of them includes about fifty separate bones, situated in the skull, the spine, the pelvis, the two legs, and the two ankles and feet. The bones in both the lower limbs are counted, because it is the average length of these two limbs that contributes to the general stature. The cartilages interposed between the bones, two at each joint, are rather more numerous than the bones themselves. The fleshy parts of the scalp of the head and of the soles of the feet conclude the list. Account should also be taken of the shape and set of many of the bones which conduce to a more or less arched instep, straight back, or high head. I noticed in the skeleton of O'Brien, the Irish giant, at the College of surgeons, which is, I believe, the tallest skeleton in any museum, that his extraordinary stature of about seven feet seven inches would have been a trifle increased if the faces of his dorsal vertebræ had been more parallel, and his back consequently straighter.

The beautiful regularity in the statures of a population, whenever they are statistically marshalled in the order of their heights, is due to the number of variable elements of which the stature is the sum. The best illustrations I have seen of this regularity were the curves of male and female statures that I obtained from the careful measurements made at

my Anthropometric laboratory in the International health exhibition last year. They were almost perfect.

The multiplicity of elements, some derived from one progenitor, some from another, must be the cause of a fact that has proved very convenient in the course of my inquiry. It is, that the stature of the children depends closely on the average stature of the two parents, and may be considered in practice as having nothing to do with their individual heights. The fact was proved as follows: After transmuting the female measurements in the way already explained, I sorted the children of parents who severally differed 1, 2, 3, 4, and 5 or more inches into separate groups. Each group was then divided into similar classes, showing the number of cases in which the children differed 1, 2, 3, etc., inches from the common average of the children in their respective families. I confined my inquiry to large families of six children and upwards, that the common average of each might be a trustworthy point of reference. The entries in each of the different groups were then seen to run in the same way, except that in the last of them the children showed a faint tendency to fall into two sets, one taking after the tall parent, the other after the short one. Therefore, when dealing with the transmission of stature from parents to children, the average height of the two parents, or, as I prefer to call it, the 'mid-parental' height, is all we need care to know about them.

It must be noted that I used the word parent without specifying the sex. The methods of statistics permit us to employ this abstract term, because the cases of a tall father being married to a short mother are balanced by those of a short father being married to a tall mother. I use the word parent to save a complication due to a fact brought out by these inquiries, that the height of the children of both sexes, but especially that of the daughters, takes after the height of the father more than it does after that of the mother. My parent data are insufficient to determine the ratio satisfactorily.

Another great merit of stature as a subject for inquiries into heredity is, that marriage selection takes little or no account of shortness or tallness. There are undoubtedly sexual preferences for moderate contrast in height; but the marriage choice appears to be guided by so many and more important considerations, that questions of stature exert no perceptible influence upon it. This is by no means my only inquiry into this subject; but, as regards the present data, my test lay in dividing the 205 male parents, and the 205 female parents, each into three groups, — tall, medium, and short (medium being taken as 67 inches and upwards to 70 inches), — and in counting the number of marriages in each possible combination between them. The result was that men and women of contrasted heights, short and tall, or tall and short, married just about as frequently as men and women of similar heights, both tall or both short: there were thirty-two cases of the one to twenty-seven of the other. In applying the law of probabilities to investigations into heredity of stature, we may regard the married folk as couples picked out of the general population at haphazard.

The advantages of stature as a subject in which the simple laws of heredity may be studied will now be understood. It is a nearly constant value that is frequently measured and recorded; and its discussion is little entangled with considerations of nurture, of the survival of the fittest, or of marriage selection. We have only to consider the mid-parentage, and not to trouble ourselves about the parents separately. The statistical variations of stature are extremely regular; so much so, that their general conformity with the results of calculations, based on the abstract law of frequency of error, is an accepted fact by anthropologists. I have made much use of the properties of that law in cross-testing my various conclusions, and always with success.

The only drawback to the use of stature is its small variability. One-half of the population with whom I dealt varied less than 1.7 inches from the average of all of them; and one-half of the offspring of similar mid-parentages varied less than 1.5 inches from the average of their own heights. On the other hand, the precision of my data is so small, partly due to the uncertainty in many cases whether the height was measured with the shoes on or off, that I find by means of an independent inquiry, that each observation, taking one with another, is liable to an error that as often as not exceeds two-thirds of an inch.

It must be clearly understood, that my inquiry is primarily into the inheritance of different degrees of tallness and shortness; that is to say, of measurements made from the crown of the head to the level of mediocrity, upwards or downwards as the case may be, and not from the crown of the head to the ground. In the population with which I deal, the level of mediocrity is 68¼ inches (without shoes). The same law applying with sufficient closeness both to tallness and shortness, we may include both under the single head of deviations; and I shall call any particular deviation a 'deviate.' By the use of this word, and that of 'mid-parentage,' we can define the law of regression very briefly. It is, that the height-deviate of the offspring is, on the average, two-thirds of the height-deviate of its mid-parentage.

If this remarkable law had been based only on experiments on the diameters of the seeds, it might well be distrusted until confirmed by other inquiries. If it were corroborated merely by the observations on human stature, of which I am about to speak, some hesitation might be expected before its truth could be recognized in opposition to the current belief that the child tends to resemble its parents. But more can be urged than this. It is easily to be shown that we ought to expect filial regression, and that it should amount to some constant fractional part of the value of the mid-parental deviation. It is because this explanation confirms the previous observations made both on seeds and on men, that I feel justified on the present occasion in drawing attention to this elementary law.

The explanation of it is as follows: The child inherits partly from his parents, partly from his ances-

try. Speaking generally, the farther his genealogy goes back, the more numerous and varied will his ancestry become, until they cease to differ from any equally numerous sample taken at haphazard from the race at large. Their mean stature will then be the same as that of the race; in other words, it will be mediocre. Or, to put the same fact into another form, the most probable value of the mid-ancestral deviates in any remote generation is zero.

For the moment let us confine our attention to the remote ancestry, and to the mid-parentages, and ignore the intermediate generations. The combination of the zero of the ancestry with the deviate of the mid-parentage, is that of nothing with something; and the result resembles that of pouring a uniform proportion of pure water into a vessel of wine. It dilutes the wine to a constant fraction of its original alcoholic strength, whatever that strength may have been.

The intermediate generations will, each in its degree, do the same. The mid-deviate of any one of them will have a value intermediate between that of the mid-parentage and the zero value of the ancestry. Its combination with the mid-parental deviate will be as if not pure water, but a mixture of wine and water in some definite proportion, had been poured into the wine. The process throughout is one of proportionate dilutions, and therefore the joint effect of all of them is to weaken the original wine in a constant ratio.

We have no word to express the form of that ideal and composite progenitor, whom the offspring of similar mid-parentages most nearly resemble, and from whose stature their own respective heights diverge evenly, above and below. He, she, or it, may be styled the 'generant' of the group. I shall shortly explain what my notion of a generant is, but for the moment it is sufficient to show that the parents are not identical with the generant of their own offspring.

The average regression of the offspring to a constant fraction of their respective mid-parental deviations, which was first observed in the diameters of seeds, and then confirmed by observations on human stature, is now shown to be a perfectly reasonable law which might have been deductively foreseen. It is of so simple a character, that I have made an arrangement with one movable pulley, and two fixed ones, by which the probable average height of the children of known parents can be mechanically reckoned. This law tells heavily against the full hereditary transmission of any rare and valuable gift, as only a few of many children would resemble their mid-parentage. The more exceptional the gift, the more exceptional will be the good fortune of a parent who has a son who equals him, and still more if he has a son who overpasses him. The law is even-handed: it levies the same heavy succession-tax on the transmission of badness as well as of goodness. If it discourages the extravagant expectations of gifted parents that their children will inherit all their powers, it no less discountenances extravagant fears that they will inherit all their weaknesses and diseases.

The converse of this law is very far from being its numerical opposite. Because the most probable deviate of the son is only two-thirds that of his mid-parentage, it does not in the least follow that the most probable deviate of the mid-parentage is $\frac{2}{3}$, or $1\frac{1}{2}$ that of the son. The number of individuals in a population who differ little from mediocrity is so preponderant, that it is more frequently the case that an exceptional man is the somewhat exceptional son of rather mediocre parents, than the average son of very exceptional parents. It appears from the very same table of observations by which the value of the filial regression was determined, when it is read in a different way, namely, in vertical columns instead of in horizontal lines, that the most probable mid-parentage of a man is one that deviates only one-third as much as the man does. There is a great difference between this value of $\frac{1}{3}$, and the numerical converse mentioned above of $\frac{3}{2}$; it is four and a half times smaller, since $4\frac{1}{2}$, or $\frac{9}{2}$, being multiplied into $\frac{1}{3}$, is equal to $\frac{3}{2}$.

Let it not be supposed for a moment, that these figures invalidate the general doctrine that the children of a gifted pair are much more likely to be gifted than the children of a mediocre pair. What it asserts is, that the ablest child of one gifted pair is not likely to be as gifted as the ablest of all the children of very many mediocre pairs. However, as, notwithstanding this explanation, some suspicion may remain of a paradox lurking in these strongly contrasted results, I will explain the form in which the table of data was drawn up, and give an anecdote connected with it. Its outline was constructed by ruling a sheet into squares, and writing a series of heights in inches, such as 60 and under 61, 61 and under 62, etc., along its top, and another similar series down its side. The former referred to the height of offspring, the latter to that of mid-parentages. Each square in the table was formed by the intersection of a vertical column with a horizontal one; and in each square was inserted the number of children out of the 930 who were of the height indicated by the heading of the vertical column, and who, at the same time, were born of mid-parentages of the height indicated at the side of the horizontal column. I take an entry out of the table as an example. In the square where the vertical column headed [1] 69– is intersected by the horizontal column by whose side 67– is marked, the entry 38 is found; this means, that, out of the 930 children, 38 were born of mid-parentages of 69 and under 70 inches, who also were 67 and under 68 inches in height. I found it hard at first to catch the full significance of the entries in the table, which had curious relations that were very interesting to investigate. Lines drawn through entries of the same value formed a series of concentric and similar ellipses. Their common centre lay at the intersection of the vertical and horizontal lines that corresponded to $68\frac{1}{4}$ inches. Their axes were similarly inclined. The points where each ellipse in succession

[1] A matter of detail is here ignored which has nothing to do with the main principle, and would only serve to perplex if I described it.

was touched by a horizontal tangent, lay in a straight line inclined to the vertical in the ratio of $\frac{2}{3}$; those where they were touched by a vertical tangent, lay in a straight line inclined to the horizontal in the ratio of $\frac{1}{3}$. These ratios confirm the values of average regression already obtained by a different method, of $\frac{2}{3}$ from mid-parent to offspring, and of $\frac{1}{3}$ from offspring to mid-parent. These and other relations were evidently a subject for mathematical analysis and verification. They were all clearly dependent on three elementary data, supposing the law of frequency of error to be applicable throughout; these data being 1°, the measure of racial variability; 2°, that of co-family variability (counting the offspring of like mid-parentages as members of the same co-family); and, 3°, the average ratio of regression. I noted these values, and phrased the problem in abstract terms such as a competent mathematician could deal with, disentangled from all reference to heredity, and in that shape submitted it to Mr. J. Hamilton Dickson, of St. Peter's college, Cambridge. I asked him kindly to investigate for me the surface of frequency of error that would result from these three data, and the various particulars of its sections, one of which would form the ellipses to which I have alluded.

I may be permitted to say that I never felt such a glow of loyalty and respect towards the sovereignty and magnificent sway of mathematical analysis as when his answer reached me, confirming, by purely mathematical reasoning, my various and laborious statistical conclusions with far more minuteness than I had dared to hope; for the original data ran somewhat roughly, and I had to smooth them with tender caution. His calculation corrected my observed value of mid-parental regression from $\frac{1}{3}$ to $\frac{6}{17.6}$: the relation between the major and minor axis of the ellipses was changed 3 per cent, their inclination was changed less than 2°. It is obvious, then, that the law of error holds throughout the investigation with sufficient precision to be of real service, and that the various results of my statistics are not casual determinations, but strictly interdependent.

In the lecture at the Royal institution to which I have referred, I pointed out the remarkable way in which one generation was succeeded by another that proved to be its statistical counterpart. I there had to discuss the various agencies of the survival of the fittest, of relative fertility, and so forth; but the selection of human stature as the subject of investigation now enables me to get rid of all these complications, and to discuss this very curious question under its simplest form. How is it, I ask, that in each successive generation, there proves to be the same number of men per thousand who range between any limits of stature we please to specify, although the tall men are rarely descended from equally tall parents, or the short men from equally short? How is the balance from other sources so nicely made up? The answer is, that the process comprises two opposite sets of actions, one concentrative and the other dispersive, and of such a character that they necessarily neutralize one another, and fall into a state of stable equilibrium. By the first set, a system of scattered elements is replaced by another system which is less scattered; by the second set, each of these new elements becomes a centre, whence a third system of elements is dispersed. The details are as follows: In the first of these two stages, the units of the population group themselves, as it were by chance, into married couples, whence the mid-parentages are derived; and then by a regression of the values of the mid-parentages the true generants are derived. In the second stage, each generant is a centre whence the offspring diverge. The stability of the balance between the opposed tendencies is due to the regression being proportionate to the deviation, — it acts like a spring against a weight.

A simple equation connects the three data of race variability, of the ratio of regression, and of co-family variability; whence, if any two are given, the third may be found. My observations give separate measures of all three, and their values fit well into the equation, which is of the simple form, —

$$v^2\frac{p^2}{2} + f^2 = p^2,$$

where $v = \frac{2}{3}$, $p = 1.7$, $f = 1.5$.

It will therefore be understood that a complete table of mid-parental and filial heights may be calculated from two simple numbers.

It will be gathered from what has been said, that a mid-parental deviate of one unit implies a mid-grandparental deviate of $\frac{1}{3}$, a mid-ancestral unit in the next generation of $\frac{1}{9}$, and so on. I reckon from these and other data, by methods that I cannot stop to explain, that the heritage derived on an average from the mid-parental deviate, independently of what it may imply, or of what may be known concerning the previous ancestry, is only $\frac{1}{2}$. Consequently, that similarly derived from a single parent is only $\frac{1}{4}$, and that from a single grandparent is only $\frac{1}{16}$.

The most elementary data upon which a complete table of mid-parental and filial heights admits of being constructed, are, 1°, the ratio between the mid-parental and the rest of the ancestral influences; and, 2°, the measure of the co-family variability.

I cannot now pursue the numerous branches that spring from the data I have given, as from a root. I will not speak of the continued domination of one type over others, or of the persistency of unimportant characteristics, or of the inheritance of disease, which is complicated in many cases by the requisite concurrence of two separate heritages, the one of a susceptible constitution, the other of the germs of the disease. Still less can I enter upon the subject of fraternal characteristics, which I have also worked out. It will suffice for the present to have shown some of the more important conditions associated with the idea of race, and how the vague word 'type' may be defined by peculiarities in hereditary transmission; at all events, when that word is applied to any single quality, such as stature. To include those

numerous qualities the ... we must omit reference ... and frame the definit ... form towards which ... ate from each in turn.

The stability of a ... ured by the strength of ... a mean regression from ... the offspring would ... bility as if it had been ...

The mean regression ... easily ascertained, but I ... ing it. It has already been stated that ... lation vary less than 2.7 inches from ... being what is technically known as the ... deviation. The mean deviation is, by a well ... theory, 1.18 times that of the probable deviation; therefore in this case it is 1.9 inches. The mean loss through regression is ; of that amount, or a little more than .6 inch. That is to say, taking one child with another, the mean amount by which they fall short of their mid-parental peculiarity of stature is rather more than six-tenths of an inch.

With respect to these and the other numerical estimates, I wish emphatically to say, that I offer them only as being serviceably approximate, though they are mutually consistent; and with the desire that they may be reinvestigated by the help of more abundant and much more accurate *measurements* than those I have had at command. There are ... simple and interesting ... unable to assign ... quate material, such as ... time back, of the ... over the ... daughters.

The ... regression ... ferences ... still ... can ... ...

The appearance of a new and useful family peculiarity is a boon to breeders, who by selection in mating gradually reduce the preponderance of those ancestral elements that endanger reversion. The appearance of a new type is due to causes that lie beyond our reach; so we ought to welcome every useful one as a happy chance, and do our best to domicile and perpetuate it. When heredity shall have become much better, and more generally understood than now, I can believe that we shall look upon a neglect to conserve any valuable form of family type as a wrongful waste of opportunity. The appearance of each new natural peculiarity is a faltering step in the upward journey of evolution, over which, in outward appearance, the whole living world is blindly blundering and stumbling, but whose general direction man has the intelligence dimly to discern, and whose progress he has power to facilitate.

A NEW THEORY OF COHESION.

SINCE a great part of the relations discussed in a paper by Dr. H. Whiting, on a new theory of cohesion (*Proc. Amer. acad.*, xix. 353), are determined by the equation between the pressure, volume, and temperature of a given quantity of the substance considered, a comparison of the form of this equation as given in this paper with forms previously proposed affords the readiest means of comparing the author's results with those of previous investigators. The equation proposed in 1873 by Van der Waals has the form

$$\left(p + \frac{a}{v^2}\right)\left(1 - \frac{b}{v}\right)v = Rt; \qquad (1)$$

that of the present paper (see p. 376, third equation) may be written

$$\left(p + \frac{a}{v^2}\right)\left(1 - \sqrt[3]{\frac{c}{v}}\right)v = Rt. \qquad (2)$$

In both equations, p, v, and t denote pressure, volume, and absolute temperature: the other letters denote constants, to be determined by the nature of the substance considered.

We may get some idea of the numerical difference in the indications of these equations, if we observe that the ratio of the volume of the critical state to that which would be required by the laws of Boyle and Charles is 0.375 by the first equation, and 0.556 by the second (the experiments of Dr. Andrews give something like 0.414 for carbonic acid). Again: the ratio of the volume of the critical state to that at absolute zero would be 3 by the first equation (which, however, was not intended to apply to such a determination), and 3.58 by the second.

The equation of Dr. Whiting has an important property in common with that of Van der Waals. If we use the pressure, volume, and temperature of the critical state as units for the measurement of the pressure, volume, and temperature of all states, the constants will disappear from either equation, and we obtain a relation between the pressure, volume, and temperature (thus measured), which should be the same for all bodies. From this property of his equation, independently of the particular relation obtained, Van der Waals has derived a considerable number of interesting conclusions, which would equally follow from the equation of Dr. Whiting (see the twelfth and thirteenth chapters of the German translation of the memoirs of the former, by Dr. Roth, Leipzig, 1881). One of these is mentioned in Dr. Whiting's treatise, p. 427.

It is well known that the equation of Van der Waals agrees with experiment to an extent which is quite remarkable when the simplicity of the equation is considered, and the complexity of the problem to which it relates. But it was not intended to be applied to states as dense as the ordinary liquid state. Dr. Whiting's equation, on the other hand, seems to have been formed with especial reference to the denser conditions of matter, and, from the numerical verifications which are given, would appear to represent the ordinary liquid state, in some respects at least, much better than the equation of Van der Waals. The principal verifications relate to the coefficient of expansion and the critical temperature. When the pressure may be neglected, as in the ordinary liquid state, equation (2) gives

$$\frac{de}{dt} = \frac{7}{3}e^2 + \frac{4}{3}te^3,$$

where e is the coefficient of expansion $\left(\frac{dv}{vdt}\right)$. A very elaborate comparison is made between this equation and the experiments of Kopp, Pierre, and Thorpe. An empirical formula of Dr. Mendelejeff is also considered, which gives

$$\frac{de}{dt} = e^2,$$

a value of de/dt about one-third as great as Dr. Whiting's. We may add that the equation (1) of Van der Waals would give

$$\frac{de}{dt} = 3e^2 + 2te^3,$$

a value of de/dt about one-third greater than Dr. Whiting's. The result seems to be that the indications of experiment lie between the formulae of Dr. Whiting and Dr. Mendelejeff (pp. 424 ff.). We may conclude that they would not agree so well with that of Van der Waals.

Each of the equations (1) and (2) will give the critical temperature when we know the coefficient of expansion for a given temperature. Dr. Whiting has calculated the critical temperature, by means of his equation, for twenty-six substances for which this temperature has been observed. The calculated and observed values generally differ by less than ten degrees Centigrade. An equation derived by Thorpe and Rücker, in part from the formula of Mendelejeff above mentioned, and in part from a principle of Van der Waals, gives about the same agreement with experiment. We may add that the general equation of Van der Waals, taken alone, would give for the critical temperature t_c the formula

$$t_c = \frac{8(2te + 1)^2}{27e(te + 1)},$$

which does not seem, from the test of a few cases, to agree so well with experiment.

In establishing his fundamental equations, Dr. Whiting, like Van der Waals, treats the molecules as elastic spheres which attract one another when not in contact. The cohesive effect of the molecular attraction is regarded by both as proportional to the square of the density. It is, in fact, represented by the same term $\left(\frac{a}{v^2}\right)$ in equations (1) and (2). This effect is deduced by Dr. Whiting from the hypothesis of a molecular attraction varying inversely as the fourth power of the distance, by supposing a body to expand so that every distance is increased in the same ratio; but such an expansion is entirely unlike any which actually occur in fluids, since it increases the distance within which the centres of molecules do not approach one another. We shall probably come much nearer to the case of nature, if we suppose that the average number of molecules in a fluid, which are between the distances r and $r + dr$ from a given molecule, varies as the density of the fluid. This supposition will evidently make the cohesive effect of the molecular attraction vary as the square of the density. It would seem that any agreement of experiment with the indications either of equation (1) or of equation (2) should be regarded as confirmatory of this law of the distribution of the molecules rather than of any particular law of attraction.

THURSTON'S FRICTION AND LOST WORK.

THIS volume combines characteristics not too often found in a work on this or kindred subjects. It is thoroughly scientific in method, as well as in the treatment of separate problems. It is eminently practical in results, as well as in the selection and range of the problems considered. It is clear, accurate, and minute in the details which give completeness to its discussions, and make them readily available for actual use. It is not merely or principally a compilation. While it brings together the formulae and results of the standard writers and experimenters upon friction, its laws, modifications, and effects, it also includes the author's own elaborate experiments, made with a view to their bearing upon questions of daily and vital importance to the engineer and the student. The conclusions drawn from these experiments, being always subject to comparison with the facts and knowledge gained by the author in a wide and extensive engineering practice, are rational and reliable. The book comprises eight chapters. The first explains the object of mechanism, the manner of computing work and power, the laws of the persistence and transformation of energy, and the relation of lost work to the efficiency of mechanism. In the second chapter, the theory and laws of friction are developed. The problems which arise in practice are taken up one by one, clearly analyzed, mathematically solved, and the applications of the resulting formulae pointed out.

The next three chapters form an exhaustive treatise on the lubricants used for reducing friction; their nature and relative values; the means of applying and using; methods of analyzing, inspecting, and testing them. Cuts of the best lubricators in use, and also of the apparatus used in making physical tests; tables giving physical and chemical properties of oils, their color reactions, density, specific gravity, and viscosity; and diagrams showing the relations of viscosity and lubrication, and effects of temperature upon viscosity, accompany the text. Oleography and electrical conductivity are noticed as methods of identifying various oils. The nature and effects of friction, and the kinds and properties of lubricants, having been thus fully discussed, the author proceeds to the subject of experiments, from which must be obtained the values of constants which enter into all the formulae. Upon the correctness of these values depends the accuracy of results obtained by calculation from the formulae developed by the theoretical investigations.

The sixth chapter relates to experiments of two kinds: First, those designed to ascertain the relative amounts of friction between different surfaces under varying conditions; to determine constants, or suggest the value and form of empirical formulae, applicable to friction of both solids and fluids. Second, experiments with machines for testing lubricants, with cuts and descriptions of oil-testing machines. The mathematical theory and method of using Thurston's machine are given in detail, together with tables showing records of oil-tests made by the author with his machine. The seventh chapter gives results of experiments with lubricants, showing their effects in modifying friction; their endurance under different conditions of pressure and velocity; and the effect of changes of pressure and velocity upon the coefficient of friction.

It is impossible to give in a brief review an adequate idea of the minuteness of detail with which the wide range of problems and experiments are discussed. The reader may expect to find, substantially, all that is known upon these subjects through the investigations of earlier writers, supplemented by the results of

Friction and lost work in machinery and mill-work. By R. H. THURSTON. New York, *Wiley*, 1885. 12+365 p., illustr. 8°.

the author's own work in his professional practice, and in carefully conducted experiments.

A somewhat novel feature of the book, and one which will commend it to the manufacturer and mill-owner, is the closing chapter on 'The finance of lost work.' The lost work, the cost of the lubricant, the quantity used, and the saving or loss of energy effected by the change of one lubricant for a better or a poorer, are represented by symbols, and embodied in equations, by which general principles, as well as special results, are reached. The application of these equations is illustrated by the solution of several problems.

While the author points out the need of more extended experiments in some directions, and warns the reader against drawing conclusions too hastily from insufficient data, it would seem that the method outlined, and so extensively pursued, covers the whole ground of investigation required for the complete solution of all questions relating to losses due to friction in mechanism.

DARWIN'S BIOGRAPHY.

Some men are great, and some men famous: a few are both, and among them Darwin is pre-eminent. Greatness is a quality, fame a circumstance, which greatness, unhelped by fortune, cannot secure. In this century, there have been many great intellects celebrated to the votaries of science for their achievements, yet not famous with the public. Darwin is not solitarily pre-eminent: of his own generation we may count a number his compeers. He stands high aloft, yet he is even overtopped in sheer greatness by his greatest contemporaries; but, among them all, not one equals Darwin in deserved fame. The influential importance of a discovery is measured neither by the ability of the discoverer, nor by the magnitude of the difficulties overcome. There have been other intellectual efforts as successful and grand in their making and results, as that which established the Darwinian theory, but, in our time, no other of equally profound far-reaching and lasting significance to mankind.

In studying Darwin we have to bear in mind to separate the greatness of the man from the fame of his influence. The time has not yet come to fully estimate the man — we must await the biography promised by the family; but we are already able to appreciate the directness and force of his intellect, his noble candor, his courage under suffering, and, above all, his insatiable love of knowledge and research; we can appreciate also the revolution of belief he caused.

If a poet were to imagine forth a career, which without adventurous incident, or participation in the great affairs of nations, should stir the world, he might, if a great artist, conceive a character at once simple and noble; endowed with irrepressible love of knowledge; given over to study; indefatigable in gathering facts, and always marshalling them into logical phalanxes, making the front and flanks of his evidence alike impregnable: he would place this character aside from the bustle of the world, and perhaps add ill health to the conditions to enforce closer retirement, and accentuate the obscurity of secluded labor; and the poet-artist would endow his created man with means, that his life might be altogether devoted to study, without pecuniary harassments to impede the absolute concentration of mental effort. Last of all, the poet's conception includes a great idea. For year after year the toil would continue, unheeded but prosperous, until the long-growing thought becomes a proven generalization — the whilom mystery of nature is clarified. At last the result is given to the world; it turns the minds of men topsy-turvy: all civilized nations are convulsed with the turmoil of discussion, angry and turbulent: the suddenly famous philosopher maintains his retirement; he withholds himself from all share in the profitless fury he has aroused; he does not swerve from the continuation of his unobtrusive labors, but repeatedly re-enforces by more facts and more logic his published generalization. In a few years the vituperation, which was hurled at him in unmeasurable quantity, ceases; yet a little while, and his due is paid — fully: the world, that had but just now reviled him, turns about and acknowledges the mighty progress the one man has accomplished for all. Now the work is finished: the rich recompense of universal gratitude has been earned and received. Then the life closes, honored by every class and in every country. At his death it is already known that this student's name will henceforth mark the century in which he lived, because the kings, generals, and politicians of his time are all less than the unpretentious investigator.

Our supposed poet, the maker of this his-

Charles Darwin und sein verhältniss zu Deutschland. Von Dr. Ernst Krause. Mit zahlreichen bisher ungedruckten briefen Darwins, zwei portraits, handschriftprobe, u.s.w., m. lichtdruck. Leipzig, *Günther*, 1885. 8+236 p. 8°.

tory, would have given us one of the noblest creations of genius, — one full of inspiration to every master and drudge of science. But the poet is too late: the career he should invent has been lived in reality by Darwin. Can any one contemplate it, and not feel that it is beautiful?

The biography of Darwin is a theme worthy of genius: it should be written with eloquence, as well as with insight and discrimination. But Darwin's life possesses so much inherent interest, that any conscientious narrative of it must be meritorious. Dr. Krause furnishes us with a biography the preliminary character of which is frankly confessed. It is not in any sense the great work we hope for, nevertheless it deserves genuine praise. The author gives a vivid and loving sketch of Darwin's career, and adds enough of the personal history to convey a clear impression of his character, which was so pure and open, that its noble traits impressed not only his friends, but also all who knew him. Indeed, there are many who feel that the man was finer than any of his works. Dr. Krause, as was natural for the editor of the German evolutionary magazine, *Kosmos*, has made his book more than a personal history by including an account of the rise and triumph of the Darwinian theory. All this is so well done, that the book affords a very clear idea of the inception of the theory, and of the leading episodes of the prolonged warfare which was initiated by the publication of the 'Origin of species.' It is certainly a very interesting history, plainly but well told. Moreover the volume, albeit not large, contains a sufficient outline of all Darwin's chief investigations. The principal excellence of the work, however, lies in the correlations it establishes between Darwin's labors and both the circumstances of his life and his personal traits. In short, we commend the book as the best available source of a general knowledge of Darwin. The volume gains in interest by a couple of fairly good portraits — a view of Darwin's home at Down, a *facsimile* of an autograph letter — and the publication of a not inconsiderable number of letters from Darwin to various German naturalists. It is well printed in clear Roman type, not in Gothic abominations. It may be noted, that it is to be followed by a companion volume of translations into German of such of Darwin's smaller writings as have not previously appeared in that language. We hope that this biography will be soon published in English translation.

We have endeavored to express the twofold nature of the interest Darwin excites. Dr. Krause portrays his greatness, but his fame must be explained more fully hereafter by some profound philosopher who knows thoroughly and understandingly the intellectual history of the nineteenth century.

EDIBLE AND POISONOUS FUNGI.

ALTHOUGH the larger fungi, popularly called toadstools and mushrooms, are not so dangerous as is generally believed, it is certainly a difficult matter for the public to distinguish between the forms which are edible, and those which are injurious, or even fatal. The two charts, with twelve colored plates by Prang, are intended to aid those who are not botanical experts, in recognizing some of our more common edible and poisonous species. With each plate is a brief description of the species figured, and directions for cooking; and, under the heading of 'general directions,' Mr. Julius A. Palmer gives a short account of the distinctions between poisonous and edible fungi. The plates are, in general, well executed and characteristic; and some of the best edible species, as Coprinus comatus, would be recognized, without hesitation, by the most inexperienced. The plate showing puffballs is not well done from a botanical point of view; and, with regard to the plates in which several different species are shown in one group, it may be said that the effect is confusing; especially in the plate of Russulae, where, after the directions for cooking, the warning is added, "the noxious members of this family resemble the esculent so closely, that, to the amateur, tasting each one as gathered is the only guide; the hurtful ones being always hot and acrid." In such a case, one would suppose that plates would be of little use to the general public. In continuations of this work, it is to be hoped that the crowding of several species on one plate will be abandoned.

If Americans do not make use of fungi to the same extent as some other nations, it is, perhaps, quite as much owing to their ignorance of the way to cook them, as fear of mistaking the edible and noxious forms. Numbers of our common species are delicious when well cooked: but on the other hand, as usually prepared for the table, they are quite the reverse; and, until the number of good cooks is much greater than it is now, we can hardly expect fungi to become a very popular

Mushrooms of America, edible and poisonous. By JULIUS A. PALMER, jun. Boston, *Prang*, 1885.

article of food. The mycophagists of the country are not as yet numerous; but they sometimes do an injury to their cause, by recommending the use of certain species of which perhaps the best that can be said is that they are not injurious. Agaricus procerus, and Boletus strobilaceus, figured in the present work, would not strictly be called edible, except by an enthusiastic mycophagist. We imagine that one whose first experiment in fungus-eating was made upon either of the species just named, would hardly be likely to repeat the experiment.

ROHÉ'S HYGIENE.

This book, of small size and modest appearance, is full of important matter, told in a very interesting manner. The preface says it is intended as a guide to the principles and practice of preventive medicine; and we think that every student of medicine should possess it, and study it. Air, water, food, clothing, soil, dwellings, hospitals, camp-life, and numerous other every-day topics, are discussed in condensed sections, but with clearness and intelligence. There are some points, however, which we think should receive greater attention. For instance, in giving the tests for air and water impurities, nothing is said of the methods of analyzing these media for germs. A short paragraph states that the air is the bearer of germs, and that quantitative analyses of the same have recently been made. Although the methods of such analyses are elaborate, and too expensive for students in general to undertake, nevertheless they ought to be explained in a text-book of this kind.

Emphasis is properly laid upon the dangers from sewage in drinking-water. Dr. Rohé takes exceptions to the statement, that rivers quickly purify themselves; and he quotes the report of the Massachusetts board of health for 1876, in which the foul condition of the Blackstone River was proven. He rightly claims that the rate of self-purification for rivers is limited, and may be easily exceeded by the rate of sewage pollution. The danger from using polluted ice is also described and illustrated by reference to cases of disease caused by such ice. Water does not purge itself of impurities by freezing.

The proof-reading of the book seems to have been hastily done, as we notice numerous errors of spelling. We heartily recommend the book, and praise it for the sincere and unaffected spirit in which it is written.

A text-book of hygiene. By George H. Rohé, M.D. Baltimore, *Thomas & Evans*, 1885. 8°.

THE RESCUE OF GREELY.

In welcoming Lieut. Greely to the meeting of the geographical section of the British association last summer, Capt. Bedford Pim, himself an arctic traveller of great experience, said that on one of the early expeditions in search of Sir John Franklin, the American ships were observed dashing into the ice ahead of their English companions. "Yes," said an old quartermaster: "they fears nothing, because they knows nothing." But now, since the return of Greely, the gallant captain added, it was evident that "the Americans knew every thing, and feared nothing." This, too, must be the verdict of every one who reads this book, and sees the way in which Schley and Emory, in two Dundee whalers, not merely kept pace with the best ships in the Dundee whaling-fleet, but, pushing by them, rescued Greely and his dying comrades hours, if not days (considering the uncertainties of ice navigation), before the other ships could have reached Cape Sabine, thus saving the lives of several of the party.

It makes an interesting story, and is well told by Professor Soley, who, we suppose, wrote the greater part, if not all, of the narrative. The introductory chapters on the gateway of the polar seas and the circumpolar stations, are too brief to be of much value; while the account of the two previous attempts to reach Greely contains little that will aid one in forming for himself an opinion as to where the responsibility for the deaths of nineteen out of the twenty-five members of the Lady Franklin Bay expedition really belongs. The volume further contains a few good pictures; a track-chart showing the route of Schley's vessels; and the official chart of the region from Baffin Bay to Lincoln Sea, first published in *Science* last February.

NOTES AND NEWS.

A letter from Dr. Willis Everette, U.S.A., who recently arrived from St. Michaels, Alaska, at San Francisco, states that his original plan of crossing from the headwaters of the White-river branch of the Yukon to the Copper River, was defeated by the impossibility of getting any companion, either white or native, to undertake the voyage with him. Being thus unaccompanied, he was incommoded by the behavior of the Upper Yukon Indians, who endeavored to purloin his supplies; and therefore he descended

The rescue of Greely. By W. S. Schley and J. R. Soley. Illustrated from the photographs and maps of the relief expedition. New York, *Charles Scribner's Sons*, 1885.

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tention to the fact, that, toward the end of November next, the circumstances appear to be extremely favorable for a recurrence of the slow meteors from Andromeda, which formed such a fine display in 1872, and which had been previously observed by Heis in 1847, by Flaugergues in 1838, and by Brandes in 1798; for if Biela's duple comet still exists in any considerable degree of condensation, and if it has preserved nearly the same orbit as during the years 1826–52, it will be in perihelion only a short time before the earth crosses the node; and the conditions for a meteoric display will be even more auspicious than in 1872. The question, however, arises, whether planetary perturbations may not have so disturbed the orbit as to have materially altered the periodic time, and to have otherwise so modified the elements as to render the meteor-shower no longer visible, at least in its best aspect, from the earth. There was no sign of the shower in 1879, and the ensuing November ought to settle the question of its continued existence. If there is no shower of these meteors in November, their absence may be interpreted as strong evidence that the meteor-system was so disturbed by contact with the earth in 1872, as to have suffered considerable modification of its orbit.

— After most careful researches, extending over many years, Professor Karl Petterson has arrived at some very important conclusions concerning the formation of the fiords in northern Norway, which are published in *Nature*. From his studies at Balsfjord, he has concluded that the granite blocks upon the surface were carried along the level of the sea on drift-ice when the sea was about one hundred and twenty feet higher than at present. A sharply defined line at this height, above which no blocks are found, seems sufficient to prove this; for, if the drift was deposited by a slowly gliding inland glacier, there would be no such line. He has therefore come to the conclusion, "that the Balsfjord is not of glacial origin, but formed an incision or depression in the mountain of older origin than the glacial age." He further believes that this conclusion may, in the main, apply to the question of the formation of all fiords in the north of Norway.

— The island of Formosa, which the French have just conquered, is very rich in vegetable and animal life, on account of its excellent climate. This island, though but three hundred and sixty kilometres long, and one hundred and forty wide from east to west, is the chief source of our camphor supply. The tree (Laurus camphora) grows in Japan, China, Sumatra, and Borneo also, but nowhere in such abundance as on Formosa. In order to obtain the camphor, the wood is cut into small bits, and placed in a crucible, from which the vapors are distilled over by a gentle heat, and collected upon a network of rice-stems.

— Since 1813 pieces of native iron have been brought from Greenland by many explorers, and have, in nearly every case, been ascribed to meteoric origin. Steenstrup, in his third voyage to Greenland (1876–1880), however, found the iron native in a basaltic rock at Asuk, in grains varying from a fraction of a millimetre to eighteen millime
on the western and northern si
and in other places. This settle
question of the origin of the Gr
and the ore may be of great co
in the future.

— The signification of the na
mountains of great height may l
chinjinga is the highest of a gro
peaks, which rise from a moun
the view from Darjiling occupies
of the horizon. Its name is a co
tion of four Tibetan words, —
'great,' *jo*, 'masses,' *nga*, 'fi
short, the five great snowy peak
in this case not explicit, but i
handful. Mount Everest of Bi
many geographers to be the l
globe, has a more attractive
— Deva-danga, 'God's hor
conversation into Deodang
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from Deva-danga, thou
takenly applied to one
Kinchinjinga uplift. I
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SCIENCE.

FRIDAY, OCTOBER 2, 1885.

USE OF THE FRENCH ACADEMY.

is almost impossible to set down in exact
the advantages which follow the estab-
ent of any institution of learning, — a col-
a university, or a learned society. It is
to point to illustrious men who have been
oped in such fellowship, and just as easy
me those of equal distinction who were
o enrolled. The publications of the body
t necessarily afford any surer evidence of
dvantages of association. In the case of
rench academy, it is easy to show how its
and its methods have been approved un-
e most diverse forms of civil government,
nerations far remote from one another,
n foreign countries as well as at home;
o analysis can be so thorough as to say
French literature would have been with-
e academy. The perpetuity of an insti-
, when it might easily be given up, is a
sign of its appreciation at home; and the
ion of its modes of procedure abroad is
nce of impartial and disinterested appro-
. The French academy has both these
s of success.

re are also other modes of judging its
. The prime object of the foundation, it
e remembered, was the improvement of
rench language; and, to promote this ob-
four specific duties were imposed upon the
y: the preparation of a dictionary, and of
es upon grammar, rhetoric, and poetry.
hetoric and poetry were never composed,
ps, — as an early historian, the abbé d'Oli-
timates, — because a very little reflection
convince such a company of writers as
cademicians, that there is nothing pecul-
the principles which govern literary ex-
on in the French language. The arts of
ure are as universal as the arts of culti-
speech; and the academy, from the study
phocles and Æschylus, Cicero and Vir-
ante and Petrarch, Shakespeare and
er, could derive lessons quite as good as
which it might gain from the study of
ets and orators of France. Not so with
ammar and vocabulary of the French
ge. To lexicography, accordingly, their
on was at once directed. Some progress
was also made in grammatical science; and the results were set forth in 1698, in a volume edited by the abbé Tallemant, and entitled 'Remarks and decisions of the French academy.'

The dictionary, however, from first to last, has been the *magnum opus* upon which successive generations of academicians have expended their force. Any one who has had a hand in the preparation of an elaborate index, catalogue, or vocabulary, — and such persons only, — can appreciate the labor of producing the dictionary of a language. For a single lexicographer to work alone, is almost futile; for him to work with co-ordinate assistants, is to multiply difficulties and questions almost in direct ratio to the number of helpers. One person can pronounce an opinion: how can a consensus be obtained in delicate matters of literary taste? We may even conjecture that it took forty times as long to produce the first edition of the dictionary on the democratic or equal-rights theory of production, which prevailed in this little republic of letters, as it would have done to produce it on a monarchic or military scheme of subordinated assistance. Was it forty times better? Even at this day, are there not many who think Littre's work far better than the latest edition of academic erudition?

Good or bad, the dictionary was of slow growth. It first appeared in 1694, in two volumes, folio. Frequent revisions have taken place, the earliest of which was begun in 1700, and published in 1718: the seventh and latest is now in progress, the first number having seen the light in 1858. Critics will vary in their estimate of the value of such a work, according to their conception of what is desirable in the dictionary of a living language. If an encyclopaedia is wanted of all the words employed by all the writers, early and recent, good and bad, — in all their uses, legitimate, obsolete, or colloquial, — including all possible derivatives, and the latest verbal inventions of technology, however barbarous, — then the dictionary of the academy will appear to be most inadequate and unsatisfactory. If, on the other hand, a standard of literary excellence is desired, — an authority to which a writer or speaker may refer if he questions the fit use of any part of speech or if he wishes to be exact and elegant in his diction, free from pro-

vincial or technical peculiarities in orthography, pronunciation, and the skilful adaptation of every word to its associates in the sentence, — then he will think that the deliberate opinion of a chosen body of literary men is far better than the *ipse dixit* of any one scholar; and he will value the collective opinion of an academy all the more highly because it is cautiously uttered.

We must not dwell too long upon this point, or we shall fail to notice other services of the academy. Its bestowal of prizes may be passed by as quite a subordinate function. Not so its election of members. To pronounce upon the comparative merits of those who are our neighbors and acquaintances, perhaps our near friends, and perhaps our annoying and troublesome rivals, is always a difficult task for the limitations of human nature. To select forty men from any great city who shall be regarded as the literary arbiters, the elect, the immortal, would be difficult if all were to be chosen at once: it may be even harder to make a selection when many candidates offer themselves for one vacant arm-chair. Probably no plan can be adopted which will work perfectly. Certainly, in politics, no plan has ever been devised for selecting invariably the best lawgivers; in religion, the best ministers; in education, the best professors. Whatever the ultimate judgment of the world may be, contemporary opinion is always questionable. It is but the ordinary result of human action that the French academy has often withheld its recognition from those who seem to have been most worthy to receive it, and bestowed its honors on others of little worth. A recent writer quotes Boileau as saying, in a fit of bad humor, "What an admirable reunion of choice spirits that is, when la Bruyère, judging his illustrious colleagues *as posterity*, wonders at finding himself seated with a Bossuet, a Fénelon, a Racine, a Boileau, and a La Fontaine!"

Notwithstanding these imperfections in human nature, and the jealousies which they evoke, there are not many who will doubt that the bestowal of academic distinctions, with a reasonable amount of safeguards, tends to the development of literary ambition. The highest genius undoubtedly rises above accessory impulses. We can hardly imagine that Shakespeare, Goethe, or Tennyson would have written more or better with the hope of academic preferment; but, with men of ordinary mould, recognition, and the want of recognition, are stimulants whose [illegible] can be clearly perceived. There [illegible] lects so strong as to be indifferent [illegible] tion, and not many who prefer [illegible] posterity to the praise of their contemporaries.

A French wit, Arsène Houssaye, has written a very bright satire on the [illegible] under the title of a history of the fauteuil. His keen and [illegible] is free from malice, and full [illegible] the actual working of an [illegible] of it is, to show, that, during the last two centuries and a half, [illegible] cession of men of the highest [illegible] one reason or another, [illegible] among the 'immortals' [illegible] worthies are considered [illegible] first arm-chair. A [illegible] Descartes, and including [illegible] Rochefoucauld, Bossuet, [illegible] Mirabeau, Lamennais, [illegible] and George Sand, [illegible] non-elect, is a sad [illegible] either the failure [illegible] triumph of human [illegible] with such a record [illegible] gests for the future [illegible] *inconnus*. [illegible] cine, Fénelon, [illegible] La Fontaine, [illegible] main, Guizot, [illegible] — all of [illegible] tals, — [illegible] deities.

But, [illegible] there [illegible] tion, [illegible] an [illegible] its [illegible] of [illegible] it [illegible]

[illegible]ufts.

[illegible]nglish slang [illegible]mith.

[illegible]cove.
[illegible]on ken.
[illegible]cary.* [Tufts, *Oliver*

[illegible]d darky.
[illegible]rkey.
[illegible]ats.
A rattle.
Flats.
Bonny-throw.
Diving.
A snitch.
[illegible]n the [illegible]
A drag.

Flash phrases.

[illegible]watch? . . . Somebody hears us. [Tuf
take care of yourself]; also
iron chest where cash is kep
[illegible]what watchword? . . Look who comes.
[illegible]ve over . . . . . Watch the man, and see whe
he goes.
[illegible]wed the cove . . . . . Go speak to the man.
[illegible]ow your [illegible] . . . . . Hold your tongue.
[illegible]I am [illegible] . . . . . I am disappointed, somebo
saw me. [Tufts, *like to*
faint out.]
[illegible] . . . . Let us make our escape.
[illegible] . . . . Wash my clothes.

f pockets.
leman's watch.
ut of doors.
daytime.

morn-

and the boiling kettle warns the sleepy one that he had better be up and ready for breakfast. To slip out into the cool morning air, to dash the water over the face and hands, and dry them on the tall grass, is the work of a moment; and, with a little shaking together, every is ready for the morning meal. This is d out by the wife, and each one silently re. The baby still sleeps on it's t the older children are relish h the vigor of young life o passes his dish to ves the tent. When boo goes out, and orm, passes into ding up the tent pins h taught, and throws up upport the smoke-flaps it female companion, and t slender sticks which fasten gether in front. The two t back the cloth in plaits a ging it together in two long back pole; and this is now tipped and allowed to fall to the ground is loosened from the upper part of es, and rapidly doubled up into a compact bundle. The baby, who has wakened lain cooing to the rattle of blue bead ngling from the bow over its cradle-board, gives a shout as the sunlight falls in its face and watches the quick motions of the mother throwing down the tent poles, thus leaving the circle free of access. It is the leader's tent which first falls as a signal to all the others.

Meanwhile the boys are out with many a whoop, and snatch of song, gathering together the ponies. The men are busy looking after the wagons, or else sit in groups and discuss the journey and the routine of the intended visits, or attend to the packing of those to be towed. All creatures are expected to bring presents to their hosts. The younger children run here and there, no doubt much in their play by the commotion. Soon the boys come riding in, women and the children in wide circles, and driving before them a motley herd of ponies, some trotting and gallopping, and others in a dogged trot nose to tail worn a path or keeping a straight line but spreading out on each side in the outward movement. As they come about with the shouting of the women without any break in their ... make a circle of ponies, and encircle ... him. The mounted men, at the ... almost close to the pack. Everyone ... rob the pack of contents the ... filled with meat and corn ...

...
...
...each
...but
...into

...d some
...e of God,
...all things;
... the Scarlet

...n organization
... out the facility
...pulses and places
...s from Maine to
...render such a league
T. W. Higginson.

DAY IN CAMP AMONG THE SIOUX.

designated for ... while the ... sleep late ... of the leaping ... ing about the ...

debted to D. B. Updike, Esq., now of Boston, for the use of a rare pamphlet without a title-page, giving the dying confession of Thomas Mount, then in jail at Newport, R. I., "and to be executed agreeable to my [his] sentence at Little Rest [R.I.] on the 27th of this month of May." The year unluckily is missing; but Mount was born at 'Middletown, East Jersey,' in 1764, being thus eighteen years younger than Tufts, who was born in 1746. Mount, however, served, like Tufts, in the revolutionary army, and was, therefore, to all intents and purposes, his contemporary; leading, moreover, the same wandering and predatory life, and confessing an equal number and variety of rascalities. The date of his list of words may be safely fixed about the year 1800, Tufts' being a few years earlier. It will be seen that they coincide as to many characteristic phrases, while Mount's list is on the whole fuller. I have not altered this glossary in any way, but have designated by an asterisk the words that agree substantially with Tufts's list, and have added a few notes in brackets. I insert also the preface and appendix to the glossary.

I shall be very much indebted to any one who can enable me to fix the precise date of Mount's execution, or of the publication of this pamphlet.

"The Flash company in London (of which Mountain, lately executed in Connecticut, was a member) had a language peculiar to themselves, and books printed in that language: Mount says he never saw any of those books; but Williams confessed to the publisher of these papers that he had seen them in London, and one of them in the possession of a J. S——rs, in Jacksonborough, S.C. This language has been taken notice of in some British magazines, but little information communicated concerning it; and therefore, to gratify the public, the following dictionary of the Flash language (so far as could be obtained from Mount and Williams), together with several Flash songs, and the oath they administer to flats (as they call the novices in the art of thieving) when they are admitted into the Flash society, are added.

The flash language.

A man	A cove.*
A woman	A blowen.*
A young woman	A young blowen.
A young lad	A young cove.
A house	A ken.
Play house or fair	Garf. [*Gaff*, Dickens.]
Master of the house	Cove of the ken.
Mistress of the house	Blowen of the ken.
Son	Young cove of the ken.
Daughter	Young blowen of the ken.
A gentleman	A swell.
A lady	A fine blowen.
A child	A kinicher.* [Tufts, *kinchen*.]
Hands	Dads.
Eyes	Peepers.
Head	Nanny.
Nose	Mugg.
Mouth	Mamma.
A hat	A kelp.
A wig	A busby. [Rev. Dr. Bush
A coat	A tog.*
A jacket	A javin.* [Tufts, *jarvel*.]
A shirt	A smisk.* [Tufts, *smish*.]
Breetches (*sic*)	Kicksees.*
Stockings	Leg-bags.*
Boots	Quill-pipes.*
Shoes	Crabs.*
Buckles	Latches.
Cash	Lowr.* [Tufts, *lour*.]
A watch	A trick.*
A guinea	A quid.*
A dollar	A wheel.*
Money of any kind	Bit.
Bad money	Blue bit.
Passing bad money	Ringing blue bit.
Gold in plate of any sort	Ridge.
Silver plate of any sort	Wedge.
Goppers	Maggs.
Silver spoons	Wedge feeders.
A horse	A pred.* [Tufts, *prad*.]
A horse-stealer	A prednapper.*
A sheep	A woolly bird.
A knife	A chive.
A pair of pistols	A pair of pops.*
A sword	A lash.
A crowbar	A gentleman.*
A thief	A prigg.
A gambler	A sharp.
A blanket or sheet	A spread. [Tufts calls a sad *a spread*.]
A bed	A dause.
Dry-goods	Chattery.
Cards	Broads or flats.
A pocketbook	A reader.
A note of any kind	A screen.
Ribbons	Dobbins.
Bread	Pinum.
Butter	A spread.
Cheese	Caz.
Victuals of any kind	Grub or peck.
Rum	Suck.*
Drunk	Sucky.
A bottle	A glaze. [Tufts applies t word to *a square of glas*.
Sugar	Pellock.
Tobacco	Weed or funk.
Tobacco-smoke	Blast of flumer.
Thief's girl	Blowen spenie, or mush.
To take	To hobble.
To lose	To sweet.
A goal	A quod or a quse.* [Tufts *qua*.]
A goalkeeper	A quod or qusecall. [Tufts *quakeeper*.]
A constable	A horney.*
A sheriff	A trapp.
A judge	A beeks. [*Beak*, English slan
A clergyman	A dull-gown's-man.
The law	Pattur.
The devil	The crimson cove.
Hell	The crimson ken.
The moon	Oliver's leary.* [Tufts, *Oliv*
The sun	Phoebus.
A fit night for stealing	A good darky.
A town	A wile.
A vessel	A barkey.
Lewd women	Cats.
A coach	A rattle.
Country people	Flats.
The highway	Bonny-throw.
Picking pockets	Diving.
One that turns evidence	A snitch.
One that robs a wagon on the highway	A drag.

Flash phrases.

*Peter (a watchword)	Somebody hears us. [Tu *take care of yourself*]; als iron chest where cash is k
Lea (another watchword)	Look who comes.
Nose the cove	Watch the man, and see wh he goes.
Go weed the cove	Go speak to the man.
Stow your weeds	Hold your tongue.
*I am spotted	I am disappointed, some saw me. [Tufts, *like t found out*.]
Let us sterry	Let us make our escape.
Rumble like a miza	Wash my clothes.

. . . . .	Picking of pockets.
ve of a trick . .	Taking a gentleman's watch.
. . . . .	Stealing clothes out of doors.
ry upon the lift,	Taking goods in the daytime.
g or morning	
. . . . .	Goods taken early in the morning, or late in the evening.
. . . . .	Robbing a gentleman on the highway.
. . . . .	Opening a door with a false key.
en	Breaking into a house.
. . . . .	Going in at a window.
. . . . .	Going up or down a chimney.
n upon the crap,	Condemned.
. . . . .	Acquitted.
. . . . .	A man to be flogged.
n upon the slum,	A place of confinement, or castle.
he cove out and	
. . . . .	I have killed a man.
l the quod . .	I have broke prison.
. . . . .	I'm in irons.
my bib	I'm crying.
topped	Going to be hanged.

ne pamphlet adds the following: —

ath at the Admission of a Flat into the ty: —

dest Flash cove taking the Flat by the him if he desires to join the Flash Com- Flat answers, Yes. The Flash cove (head im say thus: —

ear by —— that to the Flash Company I e; never divulge their secrets, nor turn gainst any of them; and if a brother is that I will hasten to relieve him, at the life and liberty; and if he suffers, en- e revenged on the person or persons who neans of bringing him to punishment.' g the above, or a similar oath, the Flat *pall;* i.e. a companion, and they two are on some expedition.

By the confession of Mount and Williams, the Flash Company have spread them- ver the continent, from Nova Scotia to t parts of Georgia; that the principal sea- are their places of general rendezvous; e number of the society at present, are seventy to eighty, males and females. receivers in the principal towns of each not only receive the stolen goods, but hops and houses for them to break into r.

metimes they swear by God, and some- e Devil: when they use the name of God, by the Old Cove, who knows all things; by the Devil, by the Cove of the Scarlet

Tufts mentions no such organization rectly or indirectly; but the facility h he found accomplices and places lment everywhere, from Maine to would seem to render such a league ible. T. W. Higginson.

Mass.

RAGE DAY IN CAMP AMONG THE SIOUX.

day designated for a journey every ir, while the stars are still shining. o sleep late are wakened by the of the leaping blaze. Shadowy forms g about the entrance to the lodge, and the boiling kettle warns the sleepy one that he had better be up and ready for breakfast. To slip out into the cool morning air, to dash the water over the face and hands, and dry them on the tall grass, is the work of a moment; and, with a little shaking together, every one is ready for the morning meal. This is portioned out by the wife, and each one silently eats his share. The baby still sleeps on its cradle-board, but the older children are relishing their broth with the vigor of young life. As each one finishes, he passes his dish to the matron, springs up, and leaves the tent. When the mother has eaten, she too goes out, and, with rapid steps and bent form, passes around the outside of the tent, pulling up the tent-pins used to hold the tent-cloth taught, and throwing down the poles which support the smoke-flaps. If there is an adult female companion, she takes out the round, slender sticks which fasten the tent-cloth together in front. The two women then fold back the cloth in plaits on each side, bringing it together in two long plaits at the back pole; and this is now tipped backward, and allowed to fall to the ground. The cloth is loosened from the upper part of the pole, and rapidly doubled up into a compact bundle. The baby, who has wakened and lain cooing to the rattle of blue beads dangling from the bow over its cradle-board, gives a shout as the sunlight falls in its face, and watches the quick motions of the mother throwing down the tent-poles, thus leaving the circle free of access. It is the leader's tent which first falls as a signal to all the others.

Meanwhile the boys are off with many a whoop, and snatch of song, gathering together the ponies. The men are busy looking after the wagons, or else sit in groups and discuss the journey and the routine of the intended visits, or attend to the packing of the gifts to be bestowed. All visitors are expected to bring presents to their hosts. The younger children run here and there, undisturbed in their play by the commotion. Soon the boys come riding in, swinging the ends of their lariats in wide circles, and driving before them a motley herd of ponies, some frisking and galloping, and others in a dogged trot, none following a path, or keeping a straight line, but spreading out on each side in the onward movement. As they come abreast with the dismantled tent, the women, without any break in their talk, make a dash at a pony, and generally capture him. The animal may, if he is good-natured, at once submit to be packed, two poles on each side, the packs containing the gala dress: bags filled with meat and corn are adjusted like

niers. Between the poles, which trail be-
d, a skin or blanket is fastened; and here
: young children and the puppy have a com-
:table time together as they journey. There
e enough ponies for all the men and women
) ride, and colts running along beside.

If wagons are to be used in travelling, the
ent-poles are tied on each side of the wagon-
box. The harness is dragged along by a wo-
man, who slings the mass of straps and buckles
on the pony's back, he giving a slight start as
the load drops on him. The buckling is quickly
done by the women, and the stores packed in the
bottom of the wagon. Finally the kettle and
coffee-pot are picked up; and nothing is left
of the camp but circles of trampled grass, each
one with a pile of ashes in its centre.

The delight of being 'off' affects every one,
the older people enjoying it sedately: the young
men dash about up on the hills, where they
stand silhouetted against the cloudless sky.
Now and then they drop from their ponies, and
lie flat on the ground, while the animal nibbles
unconcernedly. The women ride with the
stores in the bottom of the wagon, and the men
on the seat, driving. It is hard, teeth-chatter-
ing work to travel in the bottom of a springless
wagon, and no fun to ford a rapid river full of
quicksands; for down will go one wheel, and
the water come swirling in, wetting every thing
and every body. At such times the bags of pro-
visions are held high aloft in the hands: all
must take its chance. Those on the pony
fare better; for, with the feet on the he
neck, all goes well, unless the little fellow
into a very bad hole, and topples over in
water. Sometimes the men take off l
and moccasins, roll them in a bundle, t
on the head or back of the neck, a
over, leaving the pony to follow. Suc
generally have time enough to lie do
bank to dry off, and from their va
watch the struggles of the loaded w
men spring from their seat into the
tug at the wheels to save the
sinking.

All day we ride over the prai
ing up the birds, seeing the fl
lope, or catching sight of th
If location serves, about
camp, always near a stream
the work of a few moments
while the men and boys sc
The young girls go laugh
water, the older women
dry wood, and in less t
blue smoke is curling t
the kettle hanging o

fire. Each ha
in the place it
be untied and

There is a
after a hard
tling of a cam
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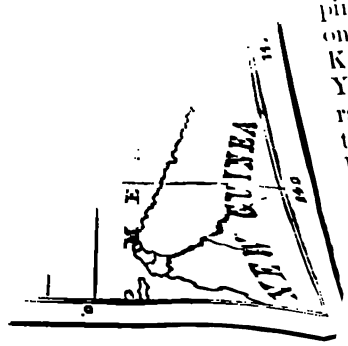

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the Carolines 5,0
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.... of fur, mins.

our own tidy housewives; that is, that it
ted, when a borrowed kettle is returned,
re will be a small portion of the food
as been cooked in the kettle remaining
ottom of the pot. The language has
cular word to designate this remnant.
this custom be disregarded by any one,
rson would never be able to borrow
s the owner must always know what
ked in her kettle.

t indignation was the result of the action
hite woman, who returned a scoured
She meant to teach a lesson in clean-
but her act was much talked over, and
ted as fresh evidence of the meanness
folk!

the savory odors give token that sup-
eady. Dishes are set in the traditional
ccupied by the members of the family,
food ladled out, and portioned to each
The little girl is sent out to call the
There is no formality about the family
If the father is a religious man, he may
it of his food, lift it up, and drop it in
; the act is without ostentation, and ap-
unobserved by the others. Some-
e children take their supper together
the tent. The mother seldom eats un-
e fully served. She may join her chil-
th her portion; or if she has female
ions in the tent, they will draw together,
sip over the meal. Every one falls to
t, and the pot is generally emptied.

eating, all lie down, stretching out in
, or going outside if the day is fine, and
in the long slanting sunlight. As the
s, a fire is kindled; and here grouped
e companionable blaze we watch the
me out. Some persons doze, some dis-
journey, or recount reminiscences of
imes: the women gather together and
e the story of the day; while the chil-
se the fireflies, or subside into drowsy
. Across the hum of voices is borne
of a young man, who, hidden in the
es on his back drumming on his breast
ngs. There are no urgent demands
y one. The matron has no dishes or
wash, or scrubbing to do; there is
to clear away after the evening meal:
e pot is emptied, and set to one side.
sitory fashions perplex the fancy of
den, no lessons to learn harass the
The men talk or sing, unconscious of
aking or losing, or questions in science
To the people, no great disasters are
, no great successes possible. The
ve silently hold their secrets, the un-
marred prairie tells no tales, and the silence of uninquisitive ignorance shuts down upon our little life.

To one thrust from the midst of civilization into so strange a camp-circle, the summer days hardly bring a realizing sense of the great estrangement between the two orders of society. It is only when the frozen calm of winter obliterates every touch of color and individuality of outline in the landscape that it becomes possible to gauge fully the mental poverty of aboriginal life. The cold nights when the tent freezes hard so that it sounds like a drum, and the frost lies thick on the bedrobes, make one dread to rise early; and the sun is often up before the fire is kindled, and the kettle bubbles with the morning meal. After looking to what comfort it is possible to give the ponies, and having gathered in the wood, the outdoor work of the day is over.

In winter the tent is made warmer by putting a lining around to half the height of the tent-cloth, and by banking without and within, stuffing with grass the space between the lower edge of the tent-cloth and the ground to keep out the wind. This done, and with plenty of wood to feed the fire, one can be passably comfortable. During the day the women are busy making clothes, mending moccasins, or embroidering gala garments with porcupine quills or beads: the men, if not out trapping, are engaged in fashioning pipes and clubs, or shaping spoons on the ball of the foot. The winter is the season for story-telling, and many hours of the evening are spent in this enjoyment.

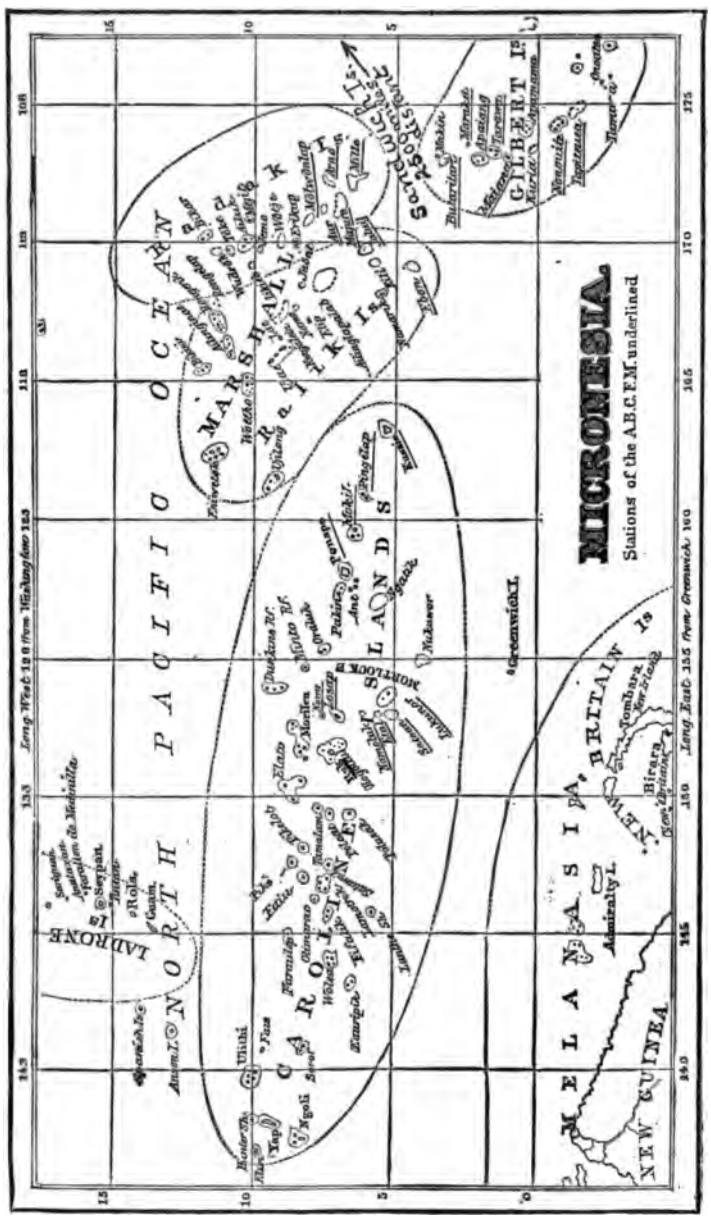
The cold season brings pleasures to the children, — snowballing, sliding down hill on blocks of ice, or standing on a flat stick and coasting swiftly, balancing with a pole. The glow on the faces of the little ones as they run in breathless from their sport to meet the welcome of the group within the tent, is about the only zest the days bring.

Alice C. Fletcher.

THE CAROLINE ISLANDS.

Micronesia, or the 'Little Islands,' is a fitting name given to that portion of the Pacific Ocean lying between 134° and 177° longitude east from Greenwich, and from 2° south to 20° north latitude. Within these boundaries it is estimated that there are not far from one thousand islands, divided into four groups, — the Gilbert, Marshall, Caroline, and Ladrone. The Ladrone Islands on the north, between 144° and 146° longitude, were discovered by Magellan

in 1581, and are under Spanish rule, being used for a penal settlement. The native population on this group is entirely extinct. The Gilbert and Marshall Islands on the eastern



side of Micronesia are all of coral formation, and with few exceptions are very small in area.

The largest group of the four is the Carolines

Map loaned by the Amer. board of comm. of for. miss.

lying north of the equator between 1 165° east longitude. They were disco 1528 by Alvaro de Saavedra, and are divided into the eastern, western, and Carolines; but there are nite boundaries to the tions. On the weste the largest islands are and Yap. These, with and Ruk in the centr Kusaie on the easte tions, are the only high the rest being of coral tion, and rising but a above the level of the The highest point on about 1,200 feet, while of Ponape is said to less than 3,000 feet. Hogoleu, is an archipel circled by an immense reef some 150 miles in The lagoon which is t closed, though irreg shape, is not far fron miles in breadth, withi are several high islanc ing from 200 to 1,000 altitude.

The climate of this is, of course, tropical, t mometer at Ponape from 70° to 87° F. Th principal products whic upon coral islands, and main support of hum are the cocoanut-palm grows wild, the bre and the pandanus or pine. Taro is also p on some of the islanc Kusaie, Ponape, Ru Yap, there is a much range of products. It that on Ponape there less than a dozen di varieties of bananas. American missionarie resided there, various fruits have been intr and also animals. Th islands are covered wit trees, and abound in and wild birds.

It is difficult to estimate the numbe habitants within the group. Ponape h 5,000, Ruk about 12,000, Yap 8, 10,000. The people belong to the bro

nesian race, having straight hair. They are tall, well formed, and vigorous, much addicted to war, yet not characteristically savage. Rev. Mr. Doane of Ponape describes the Rukite as of "a soft saffron tinge, his form symmetrical, limbs round, and of good length between joints, step easy, eye round, black, and lustrous, not dimmed by the use of ava or toddy from the cocoanut-blossom, lips rather thin for a Micronesian, hair wavy and long. I thought him a fine-looking native. Some of the women are quite beautiful." The islanders are skilful in navigating their proas, which are fitted with outriggers; and they often make long voyages without compass, though not infrequently a boat-load is drifted away, and is lost. The people throughout the islands formerly tattooed themselves, a custom which is rapidly passing away. Their houses are simply roofs on posts about four feet from the ground. In these attics they sleep with a wooden pillow and a mat covering. Until recently, there was little clothing seen on men or women. There was no marriage-rite known, though the pairing of men and women was respected. Each of the Micronesian groups has a distinct language, and within the Caroline islands the variations are more than dialectic. There are at least six or eight distinct languages within the group.

The Caroline islander as found, was not an idolater, though full of superstition. He had neither images nor temples, though certain places were avoided because he believed that they were inhabited by spirits. In a few places priests were found whose aid was sought in curing the sick. As to the government of the islands, there has been hitherto no attempt on the part of foreign powers to exercise control over them. Each island has its chief, who is absolutely independent, though sometimes controlled by a council of the people. His authority is hereditary, and is derived in the line of the mother. On a few of the islands, there is more than one tribe, in which case each division is ruled by its own chief. There is no confederation known throughout the group.

A remarkable change has been effected in the islands within the last generation. In 1852 American missionaries, under the care of the American board of foreign missions, were located on Ponape, and have since occupied Kusaie, Ruk, and the Mortlocks. From these points they have extended their labors through the agency of native helpers to several islands of the group, as well as into the Marshall and Gilbert Groups. There are at present twelve American missionaries, men and women, to be found on the islands, who are aided in their work by the Morning star, a barkentine with auxiliary steam-power, which enables them to visit the islands, and locate the native helpers. On its present voyage this vessel is expected to land teachers on the island of Yap. Since the landing of these missionaries, the whole condition of society on many of the islands has been entirely changed. In some places the whole population is found in schools; and on most of the islands occupied by Christian teachers the people are respectably clad, and are accepting the civilization and religious truth offered them. Within Micronesia the missionaries have under their care more than forty churches, with over four thousand church-members.

As to the question of the sovereignty of the Carolines, which is now in dispute between Spain and Germany, it may be said that, though Spain may claim possession on the ground of prior discovery, she has not for three centuries enforced that claim, or occupied any of the islands, unless it may be a single one nearest her Philippine possessions. Germany has no claim save on the ground that a dozen traders, more or less, have taken advantage of the improved condition of affairs, due to the labors of American missionaries, and have carried on a small trade in the dried fruit of the cocoanut. The interests of civilization and humanity do not require that either of these nations should assume control. E. E. Strong.

SCIENCE IN COMMON SCHOOLS.

Bones.[1]

Bones are the framework of the human body. If I had no more bones in me, I should not have so much shape as I have now. If I had no bones in me, I should not have so much motion, and grandma would be glad; but I like motion. Bones give me motion, because they are something hard for motion to cling to. If I had no bones, my brains, heart, lungs, and larger blood-vessels would be lying round in me sort of loose-like, and might get hurted; but not much, lest it is hard hit.

If my bones were burned, I should be all brittle, and you could crumble me up, because all the animal would be out of me. If I was soaked in a kind of acid, I should be limber. Teacher showed some bones that had been soaked. I could tie a knot in one. I had rather be soaked than burned.

Some of my bones don't grow snug, and close to my other bones, like the branches to the trunk of a tree do; and I am glad they don't; for if they did, I could not play leap-frog, and other good games I know.

[1] Composition by a boy in one of the lower grades of a New-England grammar school.

The reason they don't grow that way is because they have joints. Joints is good things to have in bones. There are two or three kinds. The ball-and-socket joint, like my shoulder, is the best. Teacher showed it to us, only it was the thigh-joint of a cow. One end was round, smooth, and whitish: that was the ball end. The other end was saucer-like: that is the socket, and it oils itself.

Another joint is the hinge-joint, like my elbow. It swings back and forth oiling itself, and never creaks like the schoolroom-door does. The other joint aint much of a joint. That is in the skull, and it don't have no motion.

All of my bones put together in their right places makes a skeleton. If I leave out any, or put some in the wrong place, it aint no skeleton. Cripples and deformed people do not have no skeletons.

Some animals have their skeletons on the outside. I'm glad I aint them animals; for my skeleton, like it is on the chart, would not look well on my outside.

This composition is an excellent illustration of 'how not to do it.' An illustration of so-called science *teaching*, telling facts to children instead of leading them to find out facts for themselves, of learning instead of the acquisition. In this case the fault lies partly with the topic. A child learns by sight and by touch, not by *faith*. While it is possible for an excellent teacher to illustrate an abstract or an abstruse subject which cannot be seen or touched, so that the child may grasp the essential points, it is not probable that one in a hundred of those now engaged in teaching will do so without too great an expenditure of time. Teachers as well as housewives often fail to remember that children and uneducated persons are able to grasp but one idea at a time. The above composition shows plainly that too many words were used in the attempt to give too many ideas to the child in too short a time.

Professor Hyatt ('Science guide' No. 1., p. 6), has well expressed the creed of those who are advocating elementary science in public schools, when he says, "The idea is not to teach, but to lead the mind to work out for itself the simple physical problems herein described, and thus almost unconsciously to arrive at the conclusions.

"The time spent in making each step is, therefore, of no consequence. The quality of the knowledge gained, and not its quantity, is alone to be considered. This sort of knowledge cannot be given by another to the scholar: it must be gained by work."

The following composition, also the work of a boy in a New-England grammar school, is an example of 'how it may be done,' and done, we venture to say, successfully; for, in clearness and accuracy, it will compar ably with the answers to examinatio tions on similar topics written by seventeen or eighteen in our higher sch

Iron Ores.

This morning the teacher passed each b specimens. One of the boys brought his s to the desk, and the teacher tried them wit net. One of them was reddish, the other wa ish, and the other was black. The yellowish the reddish one we found was not magnetic. black one was magnetic. These specimens iron ore, from which iron is obtained. F black ore, we found that the best iron was from it.

We were then told to rub each specimen o of paper. The red specimen made a red m the yellow specimen made a yellow mark. other specimen, which was black, the mo could not make it mark on account of its but our teacher told us if they were som on it, we could make it mark a black streak.

Then the teacher took some small piec yellow ore and put them in a test-tube, and tube over the flame of an alcohol-lamp, and filled around to see what it formed in the tu was water. There was no water in the tu the ore was put in, therefore it must have co the ore. This ore is called limonite or bog because it has so much water in it, and is wet, marshy places. The name of limon from a word meaning meadow.

The teacher then took them out of the t and tried them with a magnet, and found t not magnetic. It was proved that they pure iron, because they would not stick to net.

We found that these pieces of iron-ore c iron and oxygen, therefore they were iro When these pieces were rubbed on paper th a streak like the red ore. The name of thi is hematite, which means blood-red. He composed of iron, oxygen, and no water; it was supposed to be limonite, and the wat out of it by the heat of the earth.

Teacher then took the pieces of limoni was heated in the test-tube, and put them i of charcoal, which is a form of carbon, and flame of an alcohol lamp on the charcoal b pipe. After she got the most of the oxyg the pieces, she then took them on a piece and tested them with a magnet, and found t est pieces were magnetic, because they we the most. The black ore is magnetite, w tains the best iron. Ellen H. Ric

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The composition on bones, by a bo ten years old, who has been made a su science-teaching, illustrates very stro

dangers that lie in the way of a too early introduction to too difficult matter. It is by no means a bad specimen of the way in which a scientific lecture is reproduced in the young student's mind; it is, on the contrary, a remarkably favorable one. A great part of the information conveyed has been properly assimilated, and made a part of the real furniture of the boy's mind; and it is reproduced with vigor and originality. It is very different from a mere committing to memory of hard names, which might have been the effect; but it has still important warnings to convey.

The wise teacher will always take the examination-papers of her brighter pupils as a sure and searching test of the value of the instruction which she has endeavored to give. There are three plain and easy lessons which she will derive from the one before us. She will shut her eyes to the unchildlike and uncanny air of 'smartness,' — the *gamin*-like quality which is attractive in a French novel, but nauseating in real life in America; and she will attend only to the scientific ideas expressed. She will draw two morals for her next lesson on bones, and one for her scientific teaching in general. She will see that the connection between bones and the general idea of motion is far too difficult to be given to a young child. Hereafter she will tie strings or elastic bands to sticks, perhaps, and show how particular movements may be effected; but she will omit to give principles in regard to the production of motion in general. She will also refrain from calling the bony outside of certain animals a skeleton. Such fanciful extensions of the meaning of popular names will do for older children; but older children can also learn to say 'exoskeleton' and 'endoskeleton,' and the content of a name in a child's mind is a matter which is no more to be trifled with than the logical sequence of ideas. In the third place, the teacher will notice — what she has often noticed before — that it is a hazardous thing to supply a young child with reasons. Facts may be safely given in any amount, so long as they are simple, and such as he could find out for himself if put in the proper circumstances; but reasons should be given as sparingly as possible. He has not yet any means of knowing what kind of a thing a reason is; and it is of the utmost consequence that he should not be hopelessly set adrift on this subject. Probably the most characteristic of all the qualities of the untrained mind is the facility with which it is able to give a reason for every thing that happens.

Christine Ladd Franklin.

THE RESULTS OF THE KRAKATOA ERUPTION.[1]

In the spring of 1884, Messrs. René Bréon and Korthals sailed from France, under instruction from the minister of public instruction, to explore the island of Krakatoa, and study the effects of the great eruption of Aug. 27, 1883. When they arrived at the bay of Bantam, they gradually passed from islands thickly covered with a tropical vegetation, to those burned and devastated by the rain of cinders and the tidal-waves. Upon Cape St. Nicolas, the cocoa-trees were parched and yellow; and the only signs of vegetable life were the young shoots of the year, which were springing from the tops of the half-dead trees. On the coast of Bantam, the shock of the wave had broken off a reef twenty to twenty-five metres high, and ingulfed it beneath the sea. The wave which rushed with such force upon this coast destroyed the forest for a distance of three hundred or four hundred metres inland, leaving nothing standing except the great Ficus religiosa, which stretched their dry and barkless stems toward the heavens. But already nature was repairing the damage, and the powerful tropical vegetation was springing up amid the ruins.

In the bay of Lampong, there were signs of a more powerful shock. A band of land devastated by the tidal-wave rises to a height of twenty-five metres above sea-level, and the destruction begun by the sea was still farther extended inland by the rain of burning cinders which were thrown from the volcano. They proceeded up the bay, and anchored in front of the site of Telok-Betoeng, which was destroyed by the tidal-wave. It was situated on a plain but a few feet above sea-level, and was the home of a number of European merchants and dignitaries, in addition to the Malay population. The place where the town stood is now a marsh, covered with cinders, and incumbered with trunks of trees, beams, and *débris* of all kinds. A little back of this, on the sides of a hill, some European houses, and a native hut, still remain, — thanks to their position above the reach of the waves. A small river flows to the sea through the old site of the village; and near this stream, in a dense forest three kilometers from the seashore, there is a native fishing-vessel, lying where it was tossed by the inrushing waters. Near by there are others; and, a few hundred metres from there, on a bend of the stream, a large steamer, the Barrow, forms a bridge from bank to bank. It is reported that the water rose to a height of three hundred metres, which cannot be a great exaggeration of the facts.

Leaving Telok-Betoeng, they proceeded to Sebuku, one of the group of islands to which Krakatoa belongs. This is not a central volcanic cone like its neighbors Sebesie and Krakatoa, but rather a fragment of land detached from Sebesie or Sumatra by some ancient eruption. The forests on this island are much more confused than those on the border of the bay of Lampong, and one can readily see that the centre of volcanic activity is being approached. Con-

[1] Condensed from *La nature*.

tinuing the voyage, the travellers arrived at the island of Sebesie, and here the destruction was complete, — hardly a bit of herbage, hardly a trace of life, remained. A coat of gray cinders mixed with pumice,

TELOK-BETOENG BEFORE THE ERUPTION.

and fragments of a greenish, glass-like substance, covers this island to a depth of ten metres. From a distance, the sides of the hills are seen to be furrowed by ravines; and, upon nearer approach, it is found that the torrents of rain that fell during the last monsoon have washed out deep furrows in the light layers of cinders. At the bottom of one of these ravines, in the midst of the remains of houses and household utensils, fifty skeletons were found lying about. Sebesie was inhabited by two thousand Malays; and the unfortunate natives, unable to escape the hail of burning projectiles, resigned themselves to their fate, and gathered together to invoke divine protection by means of their Koran, which was found in many places scorched and torn among the ruins.

The commission soon left this island, and directed their course towards Krakatoa, the object of their visit. On the way, they passed the place where Steers and Calmayer islands had been formed in shallow water by the accumulation of ejected matter; but, to their surprise, they found that no traces of these islands remained. Their disappearance is easily explained, for so light a substance would be easily removed by the waves. The depression between these two ephemeral islands is much shallower than before.

Passing on through patches of floating pumice, the steamer neared Krakatoa, on which could be seen undulating lines similar to those on Sebesie. The north side of the island is split from east to west, [illegible] having been swallowed up in the sea, thus exposed to view from the sea-side of various volcanic strata, intersected colored veins of different sizes, [illegible]

by which the subterranean fires have forced ten rock to the surface to build the cone. smoke hung above the cone, and from it looked as if volcanic activity had [illegible] Upon nearing the shore, the cause seen. Stones of all sizes were the cliff, sending a spray [illegible] the finer dust floated upward in a cloud about the summit. This continual fall of rock the expansion caused by as they strike upon the This is proved by the greatest when the cliff, and nearly ceases the base of this cliff a depth varying [illegible] metres in a [illegible] kilometres, which the sea. The portion of the the north of island of Krakatoa — Danan with the much

The exact Capt. Hollman passed in noticed a [illegible] a height of tan, and ing [illegible] inferno they [illegible] were [illegible] secure [illegible] ng aply, ould be without its lowing man- -furnace, and . The process hat a special sub- nd the mould and and cooled together. place of sand must be arly as possible, the same for heat as glass. In such mould forming, as it were, one the glass will cool without crack- ng process is comparatively quick, ecessary. When fully heated, the are taken out, and allowed to cool in This process differs from the other glass of any thickness may be cast, where- others only glass of a uniform thickness can

will be seen from the description that these methods, although very different from each other, are but different ways of treating differently shaped articles, and that all three are based upon the principle of keeping the whole body of the glass at a uniform temperature during the operations of heating and cooling. These processes are likely to cause an important revolution in glass-making; and it seems, that, in the future, tempered glass will bear the same relation to ordinary glass that steel does to iron.

addition to known methods of glass-making. The new invention was based upon a very complicated and costly process. The objects were likely to have their shapes spoiled or their surfaces injured, and, in addition to these objections, the toughened glass was liable to burst spontaneously or by a sudden shock. The cooling influence, which acts from the surface inwards, is not in proportion to the bulk of the glass, but to its surface, and must always act more quickly where the surface is large in comparison with the volume: in a sheet, for instance, the edges cool more quickly than the middle, and the sheet is liable to explode.

Mr. Siemens has invented a process by which hardened glass may be manufactured and thoroughly toughened without this objection. His method consists of placing the parts of the object which have the least surface between slabs of a cold materi suitable for the purpose. The edges are not expos to this rapid-cooling process, and hence a unif cooling of the whole mass is secured. The pla ployed for various articles varies with their s but each is based upon the same principle. T three processes, — press-hardening, casting, third, theoretically less perfect than the ot semi-hardening, or hard-tempering, which employed advantageously in cases where cannot be used, as in the case of lam bottles, etc.

Press-hardened glass has now been for six years, and is constantly increas tance. Besides plain work, decorat scriptions, and ornaments form an of the goods produced: the process is manufacture, not simply one of hard ening. The glass is so hard that the touch it; and it cannot, therefore, manufacture. It may, however, and slightly ground. Its strength times that of ordinary glass.

The process of manufacture glass is cut and shaped in t then exposed to the *radiant* structed furnace until qui attained the required tem cold metal plates to be which varies with the always very great. Th ordinary thickness re half a minute.

It is a remarkable thus quickly heate to break. This is fact that all the h manner. The su to the uniform plates during t very high tem that it can be the same time an enamel tory as the

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S ex p

a the inhabitants of tubes, or r-fishes, in brief, the great panying its presence in ates the greatest caution y if they are to have a

...HER-PLANT.

e contains an upon the evo- t. He con- d to the lily America, from modified itself in that water, lodging ne leaves, was retained insects were caught and might have produced a ma- e plant in its growth; and the antageous to have a cup-like leaf, a few generations, have developed just was needed. After a while, boggy land found better adapted for its existence, and r-plant family would be well started.

The primitive form is now lost; and the most rudimentary species is the Venezuelan genus, Heliamphora (fig. 1), which is simply a hollow tube, with a narrow opening one-fourth the way to the bottom, and with a small rudimentary hood at the top. Nearly the whole interior of the leaf is lined with hairs, those at the bottom long and slender, and those at the top short and thick. They do not seem to be either secreting or absorbing hairs, but serve simply to prevent the escape of insects. The next advance is in our Sarracenia purpurea, so common in the eastern and northern United States. In this species, there is a more perfect tube, open only at the top, and surmounted on one side by an upright hood (fig. 2), the inner surface of which is thickly covered with short,

Fig. 1.

Fig. 2.

...irs, all pointing downward. The outer third ...erior is lined with slender bristles, the mid... ...erfectly smooth, and the upper part is ...similar to those in the mid... But ...ps to the tail, whose tips ... the ...ips of the lateral ... ...makes any ... ...marked difference from ... ...a certain distance below ... ...ds, there a ... ...ers on the ... ...ts margin in ... ...short spurs ... ...ch, when ... ...ending to ... ...ing a bunch ... ...ated pulvinus ... ...g the ... ...f the ...

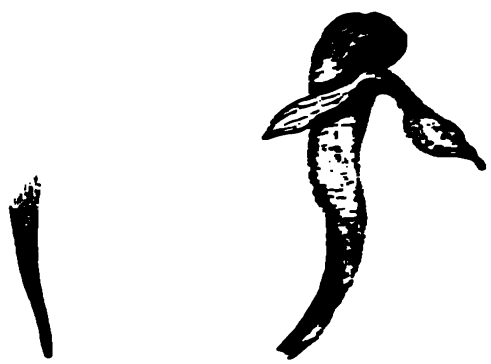

FIG. 1.

...leaf in the bird's ... ...ter with the ... ...A still further ... ...genus ... ...ter. The bird's ... ...vented with ... ...The ... ...on each side of the ... ...the whole length ... ...of this ... ...for the ... ...ground in the ... ...ing ... ...other ... ...if the ... ...

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which furnish the luminosity, clearly proves that the presence of a well-defined nervous system is not required for its manifestation, the protoplasm of their bodies alone sufficing for its development. There are no glands for secreting it, and, in some, apparently no fatty matter for slow combustion. In the coelenterates the phenomena appear to be more nearly related to nervous manifestations, though in certain cases the luminous matter possesses inherent properties of its own. While in certain annelids, again, such as Chaetopterus and Polycirrus, there are glands which may be charged with the secretion of a luminous substance, it is otherwise with certain Polynoidae, in which the emission of light appears to be an inherent property of the nervous system. The irritability in the phosphorescent examples of the latter family, however, varies considerably, some, e.g., Polynoe scolopendrina, being sluggish, while others, like Harmothoe, are extremely irritable. In the crustaceans the luminosity seems to have the nature of a secretion, probably under the control of the nervous system. In Pyrosoma and Pholas dactylus a luminous secretion is also a prominent feature; and in both the latter and the annelids, decay excites its appearance, as also is the case, to a limited extent, in fishes.

"It is evident, therefore, that the causation of phosphorescence is complex. In the one group of animals it is due to the production of a substance which can be left behind as a luminous trail. The ease, for instance, with which, in Pennatula and other coelenterates, the phosphorescence can be repeatedly produced by friction on a surface having a minute trace of the material, clearly points to other causes than nervous agency. The action, moreover, clearly affects the organic chemical affinities of the tissues engaged. On the other hand, again, as in certain annelids, it is purely a nervous action, probably resembling that which gives rise to heat."

Many of the older authors connected the emission of light with the economy of the deep sea: the same notion was brought forward in the 'Report of the cruise of the Porcupine,' 1870; and some naturalists still appear to hold a similar view. After stating the supposed benefits to be derived from the possession of this property by deep-sea forms, Professor McIntosh suggested that much caution is necessary in theorizing in this direction, explaining that, "In the first place, phosphorescent animals do not appear to be more abundant in the depths of the sea than between tide-marks, or on the surface, the latter, perhaps, presenting the maximum development of those exhibiting this phenomenon. Very many of the young that have been indicated as so brilliantly luminous become surface-forms soon after leaving the egg, and thus, at their several stages, more or less affect the three regions, — of surface, midwater, and bottom."

"A survey of the life-histories of the several phosphorescent groups affords at present no reliable data for the foundation of a theory as to the functions of luminosity." The irregularity of its occurrence in animals possessing the same structure and habits, the fact that the possessors of phosphorescence among annelids are often the inhabitants of tubes are commensalistic on star-fishes, in brief, the gr variety of condition accompanying its presence the different groups, necessitates the greatest caut in making deductions, especially if they are to hav wide application.

THE LEAVES OF THE PITCHER-PLAN

The *American naturalist* for June contains interesting article by Joseph F. James, upon the e lution of the leaves of the pitcher-plant. He c siders that the ancestral form belonged to the family, and that its home was South America, fr which, in later times, it spread and modified itself North America. He supposes that water, lodg on the upper surfaces of some leaves, was retai there; and that in this water insects were caught a drowned. Their decay might have produced a n nure which assisted the plant in its growth; and plant, finding it advantageous to have a cup-like l would then, in a few generations, have developed such a leaf as was needed. After a while, boggy la would be found better adapted for its existence, a the pitcher-plant family would be well started.

The primitive form is now lost; and the most ru mentary species is the Venezuelan genus, Helia phora (fig. 1), which is simply a hollow tube, w a narrow opening one-fourth the way to the bottom, and with a small rudimentary hood at the top. Nearly the whole interior of the leaf is lined wi hairs, those at the bottom long and slender, and thos at the top short and thick. They do not seem to b either secreting or absorbing hairs, but serve simpl to prevent the escape of insects. The next advanc is in our Sarracenia purpurea, so common in the eas ern and northern United States. In this species, the is a more perfect tube, open only at the top, and s mounted on one side by an upright hood (fig. 2), t inner surface of which is thickly covered with sho

Fig. 1.

Fig. 2.

been much in-
e size of

survives, — the phenogamous part of it in only thirty-four species, — partly at some favored points near the sea, mainly in the higher and less accessible interior portions of the island. Of two or three of the trees or shrubs, only single specimens are known; while of the redwood (Melhania erythroxylon, congener of the lost ebony, and no less valuable for the hard and durable mahogany-colored wood), which formerly abounded, only two indigenous trees survive, and hardly over a dozen planted ones.

Turning to the Bermudas, — the botany of which is exhaustively treated in the early part of the present volume, and, indeed, for the first time, — we have another example of the common fate of the aboriginal vegetation of small islands in low latitudes whenever opened to immigration. From the cultivated grounds, the indigenous vegetation is of course swept away: the uncultivated ground is covered with lantanas (here called sage-bushes) from the West Indies, and with oleanders from the Old World; also with an assortment of herbaceous weeds, some of American, but more of European, origin. The three shrubs above mentioned are said to cover more ground than all the native woody species put together. Yet the oleander was brought in only seventy years ago, the lantanas twenty or thirty years earlier.

But the change in Bermuda vegetation under human agency is by no means so striking and so pitiful as that which has happened to St. Helena. No peculiar type, and, it may be presumed, no species whatever, has here been extirpated. And that, because the Bermudas have no peculiar types, and probably never had any; and it is not improbable that the three or four species reckoned as peculiar may exist elsewhere. No genus, and hardly a well-marked species, would be lost if these little islands were submerged. Indeed, St. Helena and the Bermudas well represent the two classes of islands, the differences of which our author well describes. The first is an oceanic island, far separated by broad and deep seas from all continental land: its flora, therefore, in the main very peculiar and ancient, and the source of it wholly conjectural. Bermuda is of the continental class, is near to South America and the West Indies, from which it has obviously received its plants, and at a comparatively recent period. Like all such islands, its indigenous vegetation is meagre in kinds; and while 'the things themselves are neither rich nor rare,' it is not difficult to guess whence they came, and how they got there.

"The one striking feature in the softly undulating landscape is the ubiquitous cedar, relieved here and there by clusters and isolated individuals of the palmetto." These are, indeed, the only indigenous trees in Bermuda. The palm (Sabal Blackburniana) is counted as endemic, yet with doubt whether it is not also West Indian. Its botanical history is curious, and is well worked out in this report; and so likewise of the cedar (Juniperus Bermudiana), which is also West Indian, and is very near to our common red cedar. Both trees appear to be in no danger of eradication; for they seed abundantly, and germinate freely.

The other insular floras, of which this volume collects and discusses the existing materials, are mainly those of Fernando de Noronha, Ascension, the Tristan da Cunha group, the Crozets and Kerguelen Island in the South Atlantic and Southern Oceans, Juan Fernandez and the adjacent Masafuera, near Chili, the South-eastern Moluccas, and the Admiralty Islands. Of all these, the historical and bibliographical data are carefully worked up, and the bearings of the facts upon the problems of distribution briefly indicated.

The appendix, on the dispersal of plants by oceanic currents and birds, is a full compilation of what is known respecting such dispersion, — at least, for the regions with which these reports are concerned. A list of plants, certainly or probably dispersed by oceanic currents, is given on pp. 42–44 of the Introduction. This introductory essay upon the characteristics of insular floras, with an analysis of some of them, is, perhaps, the most widely interesting portion of the volume. Mr. Hemsley tells us of his hopes, that Sir Joseph Hooker would have undertaken this; but his multifarious duties rendered it impracticable for him now to address himself to this subject, which he has formerly discussed in the most masterly way, and with the advantage of the largest personal experience. The actual author, although new to the field, has made a creditable essay. A. G.

SOME WORKS ON GEOLOGY AND GEOGRAPHY.

The early issue of a second edition of Geikie's Geology bears witness to the success of this excellent work. The author's preface states that it has been thoroughly revised, and that by abridgment when possible, and by use of a different type from that of the first edition,

Text-book of geology. By Archibald Geikie. Second edition, revised and enlarged. London, 1885.

Physikalische geographie von Griechenland mit besonderr rücksicht auf das alterthum. By Dr. C. Neumann and Dr. J. Partsch. Breslau, *Koebner*, 1885. 476 p. 8°.

ents of the volume have been much in- without adding seriously to the size of ume. The references, which made so and novel a feature of the original re also extended, and include material as the results of Peach's and Horne's in the Scotch Highlands, which are to with admirable frankness, although o counter to the author's earlier work nions. The wonderful epitome of his- ology presented in Great Britain ren- ustrations from other countries much essary than they would be in any other of the same area, so that the work is lly and intentionally British in charac- t the general discussions of the first rds of the volume make it a standard of e wherever geology is studied. Men- progress in this country are necessarily ut they are well chosen and appreciа- om Whitney and Wadsworth's 'Azoic ,' which is characterized as a 'full and t discussion,' to Chamberlin's report on rminal moraine,' — an 'admirable sum- with which every student of glacial ought to make himself familiar.

second volume of Günther's 'Geo- ' (Stuttgart, *Enke*, 1885) follows soon e first, which was lately noticed in *Sci-* The contents are, 'Terrestrial magne- Atmospherology,' 'Oceanography,' and named physical study of the dry land. the first volume, the form of treatment es a history and discussion of every im- t question, with liberal references to the re of the subject. Under many head- he discussion is necessarily brief, and hardly more than to open and close the n, without occupying a middle ground ed with details of fact; but elsewhere, lealing with matters in which scientific ion is still active, — as the aurora, the of the sky, hail, sun-spot cycles, varia- sea-level, and others, — there is fuller ration. The two volumes show a read- most extraordinary breadth and critical and form a compendium that must be nsable to teachers and advanced stu-

Partsch has completed a work begun teacher and predecessor, Dr. Neumann; e result of their joint labors makes a hensive handbook on the physical geog- f Greece. Explorations in late years trian geologists, have given much ma- or the description of its structural his- d the climatic chapter is made thorough from Dr. Hann of Vienna. Santorin receives a full account, although active volcanoes were not known in Greece at the time of its ancient flourishing. Earthquakes, on the other hand, have always been common, and the more important ones are described. Modern chronicles show certain periodicities in the occurrence of Grecian earthquakes; and this makes the loss of the ancient catalogue by Demetrius of Callatis all the more regrettable. Forel's ingenious explanation is quoted for the puzzling currents of Euripos; the six-hour currents at time of new and full moon depending on the tides from the larger basin to the south, the two-hour currents at time of lunar quadratures arising from the gentle oscillations (*seiches*) of the smaller basin on the north. A work of this monographic character is as interesting a task as the student can set before him. It brings him a wide range of acquaintance with writings on subjects allied to those he discusses, and in turn introduces him to a larger circle of readers than is attracted by most authors; and this is especially true when the task has been so well performed as in the volume before us. It is as useful to classical scholars and historians as to geographers and naturalists.

INFECTIOUS DISEASES.

THE recent rapid revolution in medical theories regarding the nature of a large group of diseases, has made antiquated the books which only a short time ago were quoted as high authority. A new text-book, therefore, by so able and polished a writer as Professor Liebermeister, must be a welcome contribution to the library of every medical student. The first volume is devoted to that group of diseases upon which is riveted the attention of all sanitarians, as well as physicians, at the present time. It deals with the infectious diseases, and the story of the hidden mysteries of this strange world of minute germs is told in a fascinating manner.

The word infection was originally applied to every form of poisoning; but it is now restricted to the pollution of the body by a special kind of poison, which has the property of reproduction and self-multiplication to an indefinite degree under favorable conditions. This power of multiplication has long been recognized in certain diseases, and has in former times led to the suspicion that the poison of those diseases consisted of particular living entities; and recent investigations have

Vorlesungen über specielle pathologie und therapie. Von Dr. C. LIEBERMEISTER. Leipzig, *Vogel*, 1885. 8°.

proven to an absolute certainty that small, microscopic organisms, called micrococci, bacteria, schizomycetes, etc., are the sole cause and essence of a large number of diseases, and that without these organisms present in the body such diseases are impossible. It seems queer, that among all the mystical, visionary theories of disease imagined by the poetical fancies of the ancients, one theory, most visionary and fairy-like of all, should to-day become the established creed of sceptical science. The idea that minute organisms, visible only by certain devices of the microscopist, should invade our bodies, and, there selecting their appropriate abodes, should, by rapid multiplication, become the cause of typhoid-fever, small-pox, diphtheria, consumption, and numerous other diseases, seems like a fable; and yet such is the truth. The casting out of evil spirits is not wholly a figure of speech, and heathen incantations and the beatings of drums were but the earliest attempts to solve the problem of dislodgement which is pressing us hard at the present day.

In the introductory pages of his work, Professor Liebermeister defines and classifies the different varieties of infectious diseases in a very clear manner. He first divides those diseases into the miasmatic and the contagious. By miasmatic, he designates those diseases whose germs are primarily generated outside of, and independently of, any diseased body. Contagious diseases are those whose specific germs arise only in organisms suffering the special diseases. Contagious germs can be transferred from a sick man directly to a well man by simple contact, and they may then produce the same disease in this second person. Miasmatic germs, however, are bred in special localities, — in the soil and water, — and they attack those who come to these localities, but are not transferable from person to person. The contagious diseases, therefore, are *epidemic;* the miasmatic, *endemic.* A third group of these diseases includes a number whose germs appear to require two stages of development — first in the body, and then outside of it — before they become qualified to infect a new body. Thus cholera is not directly transferable from person to person, and men are also attacked who never saw another sick with cholera. On the other hand, it is equally certain that cholera never arises in any place outside of the East Indies, except it is brought to that place by human agency. Professor Liebermeister's explanation of these apparently contradictory facts is very logical and satisfactory. He assumes that cholera germs, when first expelled from a diseased bod innocuous; but, falling upon suitable cond of temperature and moisture, they d the fatal properties which render them to those who then come in contact with Typhoid-fever exhibits similar contradi as regards its methods of transmissio such contradictions become clear and ha ous in the light of this theory. The exc of one typhoid-patient in Pennsylvania, out upon the hillside to ripen its deadl son, killed hundreds of people in the t Plymouth a few weeks later. The ne for the instantaneous disinfection of excreta of these diseases should be one fundamental principles of sanitation ta every child in every school in the land. up people do not go to school, and the slowly. Children at the right age sho taught such matters in the proper way.

In his handling of special diseases, Pr Liebermeister is short and terse, but re ably clear; and we most cordially recon his work to all.

NOTES AND NEWS.

— The 'Journal of the Franklin institute' fo ber adds another series of composite photogr the fast-increasing contributions in this field. group together the historic portraits of Wash as represented by seventeen artists. There ar composites in all, due to the variations of p in the originals; and the resemblance of the one another is stronger than the resemblance a the originals. The photographs were prep Mr. W. Curtis Taylor of Philadelphia, who for them the highest attainable accuracy. crayon drawing of one of the composites is ex at the 'Novelties exhibition' in Philadelphia.

— Dr. Heinrich Winkler, in his recently pu 'Uralaltaische völker und sprachen,' has careful comparison of the Eskimo with t guages of northern and north-eastern Asi reaches the result that it is in unmistakab relation to the Kadyak, Tschiglit, and Namoll Asiatic coast, but is in no way connected w Ural-Altaic tongues. It may have orignal ceeded from the same elementary concep speech; but it has developed a type of its o fering widely from Asiatic standards, and muc closely approaching the structure typical of t mass of American tongues, though in many presenting features peculiar to itself.

— An aerostatic school is to be establis Grenoble in connection with the artillery, be especially devoted to teaching the use of balloons in reconnoitring.

SCIENCE.—SUPPLEMENT.

FRIDAY, OCTOBER 9, 1885.

COLONIZATION IN ALGERIA.[1]

THE problem of colonization in Algeria is by no means the same as in America or Australia. In the latter countries, the native population is sparse, has no conception of the use of land for agriculture to any extent, and yields with little resistance before the advance of civilization. In Algeria, on the contrary, the natives are relatively numerous, have maintained themselves in possession of the land for centuries, often by force of arms, and, however imperfect the use they make of it, resist any encroachments upon their rights with some intelligence and a great deal of vigor.

The French government had originally no intention of colonizing Algeria, but took possession of the city of Algiers as a purely military measure. But various classes of settlers, who were entitled to French protection, continually arrived and occupied the vicinity of the city; to protect them against the marauding Arab tribes, the French generals found themselves compelled, often against their own will, to advance their lines farther and farther; and at last the government concluded definitely to hold the whole country and colonize it.

The history of the attempts at colonization since the first, in 1840, presents almost an unbroken succession of failures. Every governor-general had a theory of his own, and his first step was usually to make a clean sweep of all the arrangements of his predecessor. Marshal Valée, in imitation of the Roman military colonies, attempted to use discharged soldiers as colonists. He overlooked the fact that the ancient military colonies only flourished where the veterans succeeded in completely subjugating the former inhabitants and forcing them to work the land. The result showed how gross was his mistake in supposing that the absinthe-soaked old troopers would develop into good farmers; the 300 whom he established in 1840 at Kolea, left to a man the next year.

The next governor, Marshal Bugeand, also tried the military plan; but instead of discharged veterans, he settled soldiers who had still two years to serve, and were for that period subject to martial law. Moreover, since bachelors are not the most successful colonists, they received a three months furlough to go home and provide themselves with better-halves. The result was what might have been expected. The military colonists, hemmed in by their code of petty regulations, and prevented from anything like independent action, felt much less at ease in their settlements than in the old barrack life; and at the expiration of their time of service returned, almost without exception, to 'La Belle France.'

Besides these military attempts, some civilian settlements were founded, which promised better results. The same method had been adopted which is followed at present, and which, under the conditions which exist in Algeria, seems to be about the only one possible. The government provides a place for a village of 50 to 100 houses; it gives for each house a certain acreage of land, puts up the public buildings, provides for the water-supply and connects the village by a paved street with the main road; after this is completed, the land is parcelled out to the individual colonists, who must agree to build a stone house of certain dimensions, fence and break up the land, and set out a certain number of fruit trees. The title of possession is only provisory, and can be withdrawn if the conditions are not fulfilled; not until after a certain number of years is the title unconditional, and not until then can the land be sold.

Much has been said against this plan; but it is difficult to see how any other could be employed. It is impossible for individual enterprise to secure land for a settlement; the property-rights among the natives are in too involved a condition. Four kinds of landed property are recognized: 1st, the *Azel*, or domain-lands—property of the government, or more exactly, of the officials; 2d, the *Habbus*—property of the mosques, schools, hospitals, etc.; 3d, the *Arkh*—property of private individuals; 4th, the *Melkh*—property of families or tribes in common. The first division comprises some of the best land in the country, and there was at one time a chance to get at it for colonization; but it has now fallen into the hands of speculators, and only the forests are left for *bona fide* colonists. The *Habbus* is, of course, unavailable for colonization. The *Arkh* belongs originally to the Kabyles and Moors; the former are very reluctant to sell to foreigners, and in most places have a law which gives the next neighbor the first privilege of purchase; while such of the Moorish lands, as were saleable, have already passed into the hands of native Jews. The *Melkh* belongs to the various Arab tribes, and usually comes into

[1] From an article by Dr. W. Kobelt in *Das Ausland*.

the hands of the French government by confiscation, which the tribe suffers as the penalty of a revolt. This is practically the only land available for colonization, and it is easy enough to see that, in the presence of the revengeful Arabs, the colonies must be strong enough from the outset to protect themselves. This plan has always been expensive for the government, but a considerable number of colonies had, in some degree, succeeded during the first eight years.

In 1848, an attempt was made to settle at once some 13,500 of the unemployed workmen of Paris in Algeria. Each family received a house with a certain amount of land, stock, tools and seeds, and rations for two years. But the material was the worst possible for an agricultural colony; the workmen lived in idleness, consumed their rations, and as soon as these ceased, went back to Paris, as soon as possible. An almost identical plan was tried in 1871, with 10,000 of the discontented Alsatians, and the result was the same; in 1875 every village stood empty. From 1848 to 1871 all sorts of experiments were tried, the details of which would be tedious; the result of all was nearly or quite failure.

In 1873 a private society, the *Association protective des Alsaciens-Lorrains*, succeeded in founding three villages, which are now in a very flourishing condition. The government undertook, as usual, the works of common utility; members of the society went to Algeria and chose the sites for the villages. They required from each colonist a considerable deposit toward the general expenses of the society, and thus secured a much more thrifty class of emigrants than had figured in any former undertaking.

Besides the Alsatians, and some other Germans, a large number of Spaniards and Italians have settled in Algeria. With the increasing exportation of halfagrass from the province of Oran, there is a great demand for laborers; Kabyles enough cannot be obtained, the Arabs will do no regular work, and the French and Germans cannot endure the climate. And so natives of the south of Spain, who are accustomed to a similar climate at home, were imported. And they came to stay. They are a hard-working, sober, thrifty class of people, and after a little they usually accumulate enough to buy out some shiftless French colonist. In this way Oran and some other provinces have become almost entirely Spanish. These southern Spaniards are historically much more nearly related to the Kabyles than to the French; they do not readily assimilate with the latter; they live by themselves, and are looked on by the French with jealousy, and not without reason; for if Spain should ever get possession of Morocco, the Spanish population of Oran would probably lead to unpleasant political complications.

The French also look with a jealous eye upon the Italians, who are mostly in the eastern coast-district, where they at first came on account of the fisheries. They are not so numerous as the Spaniards; in 1881 they numbered 31,000 against 112,000 Spaniards, but many of them become naturalized and are then reckoned as French.

As to the French themselves, many of them have been successful colonists, both individually and in societies; but there is a continual drawback upon their success in the shape of the worthless character of many of the emigrants. There seems to be a general mistrust of foreigners among all the French in Algeria, from the Governor-general down to the poorest emigrant; and in the distribution of the colonial privileges, they proceed on the principle that the worst kind of a Frenchman is to be preferred to the best man of any other nation. The result is that not only all the public offices—and in the usual French fashion, their name is legion—are occupied by Frenchmen, but the best lands are often assigned to people who have no intention of thoroughly working them; they fulfil the letter of the conditions with as little labor as possible, let the land on shares to a native who works it in his own primitive way, and as soon as they have acquired a clear title, sell the land immediately, and go and repeat the experiment in another place. As in our own western states, an unscrupulous 'colonist' can often 'preëmpt' in several places at the same time. Of course the officials are aware of this state of things, but in the lack of good French colonists they have felt themselves often compelled to wink at it, even if it should happen to go against their easy French consciences. But they are only putting off the question; at the sale of the above-mentioned land, it goes, sometimes directly, sometimes after some handling by speculators, to men who intend to make good use of it, whatever their nationality; and these are quite likely to be either other Europeans or Kabyles. The latter are not to be confounded with the Arabs, who are born nomads and yield before civilization; they are accustomed to town life, take kindly to improvements, send their children to school with great eagerness, work hard and save their earnings. The great objection to them on the part of the French is that they have a too well-defined sense of their own personal and political rights, look upon the French as usurpers, and will have nothing to do with them unless it is absolutely necessary. They are constantly learning better to know their own strength, and may, not far in the future, give the French a serious problem to handle.

sity, St. Louis, who constituted the transit-of-Venus party in New Zealand in 1882, carried on, under the auspices of the coast survey, a series of gravity determinations after the transit of Venus was over, swinging pendulums—the same that had been used by Major Herschel in India, England and America—in New Zealand and Australia, at Singapore, Tokio, San Francisco and Washington.

This series served the valuable purpose of connecting together, differentially, several independent systems of gravity determinations, and when finally reduced may slightly change Professor Mendenhall's Tokio value, but is not likely to alter it materially. It is of some importance to note that, of the determinations in the vicinity of Japan, the excess at Tokio is the smallest; those at Sapporo and Kagoshima, near the northern and southern extremities of the principal Japanese islands, come next; that at Naha, out in the ocean off the Chinese coast, is still larger; while the Bonin islands, well out in the Pacific, give the greatest excess yet observed. The value coming nearest to this was also determined by Captain Leutke at Ualan, one of the most south-eastern of the Caroline group of islands, and about 5° north of the equator. It would certainly be well to reoccupy this and others of Captain Leutke's stations, in order to determine whether these abnormal values of g may be actually increasing in the Pacific.

The eclipse party, under Professor Holden, to Caroline island, 10° south of the equator and in mid-Pacific, also made, under the auspices of the coast survey, pendulum observations there, and at Honolulu and San Francisco. These results, together with those of Messrs. Smith and Pritchett will be awaited with interest.

The more we study our globe the more irregular do we find it in figure and density; and it is evident that such work as that inaugurated by Professor Mendenhall at Tokio, and that prosecuted of late years by the coast survey in all parts of the globe—where it could be economically done in connection with other necessary scientific work—is among the most important of modern contributions to our knowledge of the figure and dimensions of the earth, and is a class of work which must be carried out in connection with triangulation and astronomical determinations of latitude and longitude, before we can be at all sure that we know with sufficient precision the average value of the earth's radius, which is the unit of length or base line from which we strike out from the earth into celestial spaces, and upon which all our values of planetary and stellar distances depend.

H. M. Paul.

GEOLOGICAL CHANGES IN N WALES.[1]

From the close of the Pleistocene p ent times the main physical features o Wales have remained pretty constant. boniferous period a large part of the a stretch of ocean, the New Englan being but little older. The last main curred early in Mesozoic times, and fr to the Pleistocene period unceasing denuding, faultings and volcanic eru been at work shaping the country int hills. The Pleistocene deposits are i vast accumulations of drift and diluv derived from the erosion of the deep v highlands when the rainfall was gre present. That the rainfall in this peri greater than it has since been is prove dence of great erosion in the highlands

The cause of this interesting pluvial a large portion of the southern hemisph effects have been observed in New Zea America and South Africa—is directl with the Glacial period of the northern While the northern winter was so long to induce a large accumulation of sn that of the opposite hemisphere was mild with long and cool summers. T perpetual spring in the southern lands. alternation took place, 10,500 years aft arctic ice was so extended as to produce scale and nearer to the Australian co fogs, rain and snowstorms which now the Antarctic ocean. The present gla dition of the Antarctic regions being winter of the southern hemisphere bei ion, it may readily be perceived how t tions must have been intensified in the period when the eccentricity was three times greater than it now is. It is al that owing to the extreme difference b temperature of the south pole and t tropics, the south-east trade winds w with a greater force over a larger area, upper counter trades would return m laden with moisture.

In the highest Australian mounta Kosciusko, Dr. R. von Lendenfeld ha found proof of former glacial action. glacial action were not seen lower tha above the sea, and they did not cover more than 150 square miles. No gla there now; but patches of snow lie on tered slopes and never disappear. It is

[1] Extract from President C. S. Wilkinson's ad the annual meeting of the Linnæan society of Wales, January 28, 1885.

that patches of eternal snow are here a latitude of 37° S., about 1,500 feet lower the European Alps in a latitude of 47° N. alia the snow comes as far down in 37° as e in 52°. In New Zealand the snow and uch more extensive than in Europe at a latitude. This proves that the southern ere is colder and damper than the north-

ossil remains furnish much evidence re- the changes of climate from time to time. il plants of the Pliocene indicate a much climate, more humid and equable than the ollowing. The sudden banishment of this pical flora shows that a great climatic must have supervened in post-Pliocene ne no doubt to the glaciation of the south- ions. A small pine (Pherosphœra) inter- between a Lycopodium and a juniper is nd in one locality adhering to the cold, onstantly wet cliffs near the falls at Ka- on the Blue Mountain. This is a Tas- genus and is a remnant of the flora which d the semi-tropical pliocene vegetation.

more conclusive evidence of such a change hed by the remains of extinct animals, ow live only in Tasmania, where the mean emperature is 7° lower than in the locality ese remains are now found. The Pleisto- habitants of New South Wales included markable animals. There were the huge ous pouched lion (Thylacoleo); dipro- n animal holding the same place amongst tralian mammals that the pachyderms do the fauna of other continents; the noto- , another large herbiverous animal; the ge horned lizard, megalania; and the ing notiosaurus. The kangaroos, wom- l echinids attained far larger dimensions resent, and the remains of crocodiles have found. Wherever the soil was favorable try must have been covered with a rich on for the support of this army of her- The precise character of the flora cannot etermined; but this much is certain, that gantic animals have been extirpated by ans or other. Sir Richard Owen suggests was the cause, but of this there is no ve proof. On the other hand, striking evi- s been afforded by the dryness of the last ons, of how quickly, through want of rain, hs of waving grass may be converted into e plains; and the immediate influence of matal changes on the fauna is fully at- y the numbers of kangaroos and emus ed last year through want of sustenance estern plains.

Fragments of bones of the extinct mammalia are met with in the gravels and clays at a depth of over seventy feet from the surface, and their occurrence in such quantities and variety seems to point to a scarcity of water which would alone bring so heterogeneous an assemblage of animals together. The occurrence of remains of the crocodile attests to a previous abundance of water. Stinted in food supplies and unable, because of their great bulk, to migrate rapidly or adapt themselves readily to the altered conditions of life, diprotodon and the other large herbivores perished by degrees from the combined effects of want of sustenance, the raids of predatory beasts, and possibly the attacks of man. The last terrible struggle for existence as the supply of water failed, must have been beyond description. Now none of this vast horde remains; but their likeness may still be traced in the native bear, wombat, kangaroo, etc., which still survive on the mountain ranges and plains as the comparatively pigmy types of their gigantic predecessors.

A CONVENIENT SYSTEM OF RIVER NOMENCLATURE.

EVERY tyro in geography has learned that the Mattapony and Pamunkey are the two streams that flow into the head of the so-called York river, which is simply an estuary of Chesapeake bay; but few, I imagine, have ever been told how the first of the above names is compounded, since its tributaries are too small to be named on ordinary school maps.

A few weeks since, on approaching, the sources of the Mattapony from the north I was a little surprised at hearing the inhabitants place the accent on the last syllable in pronouncing it. Presently, coming to a brisk little mill stream and inquiring its name, I was informed that it was the *Ny* river. Soon crossing a second of about the same size, I learned that this was the *Po*. Still a third was passed not long after and this rejoiced in the name of *Ta*. Turning to the eastward soon after crossing the Ta, and proceeding some distance down the course of the river system to below the union of all three of these tributaries and crossing back over the combined stream, this was found on inquiry to be the *Tapony*. At last the mouth of the Mat was passed, only below which the river is recognized as the Mattapony. Between the junction of the Ny and the Po and above the confluence of the Ta it is said to be known as the *Pony*, although this particular portion was not traversed and this name not heard used by the in-

habitants. The system of nomenclature is, therefore, complete and symmetrical.

It is due to the people living among these streams to say that they all understand perfectly, and fully appreciate this system of naming, and, indeed, seem proud of it and anxious to explain it to strangers. So extremely simple is it that even the negro hands use it with perfect accuracy.

It occurred to me that this case might furnish a valuable suggestion to geographical explorers who are constantly called upon to give names to unknown water courses. If, instead of assigning polysyllabic names to all streams, which must be learned by the public as so many independent facts, they would use monosyllabic names for the ultimate tributaries, capable of easy composition with one another, and then designate the successive trunks formed by these tributaries by the compound word formed by their names, a rational system of nomenclature would result which would unite any river system practically under a single name, and still leave not only every tributary but every part of the main stream with a distinctive appellation. I merely throw out the suggestion without attempting here to specify such practical limitations to the general principle as will naturally occur to geographers who might contemplate its actual adoption. LESTER F. WARD.

RACIAL CHARACTERISTICS OF JEWS.

The Journal of the Anthropological institute of Great Britain for August brings a discussion on Jewish race characteristics of somewhat unusual interest. The question itself is not a new one, but the mode of presenting it is. The fundamental question involved is: "Is the race of modern Jews a pure one or not?" Hitherto the historical aspect of the problem has almost exclusively been considered in the present discussion. Mr. Joseph Jacobs, B. A., shows that anthropology and anthropometry have a distinct voice in the matter. His paper is equally valuable for the information he sets before us, as for its bearing on the ultimate question.

Mr. Jacobs argues thus: Apart from the historical record of intermixture with foreign people, an indication of the pure or wild origin of the race ought to be attainable from the study of the physiological and psychological traits of the Jews of today. These traits would be included in their (1) *vital statistics* and in their (2) *anthropometry*, or bodily measurement. Having determined in what ways they differ from their neighbors in the above respects, we are met by the important but intricate problem with which Mr. Galton has familiarized the public,—Do these peculiarities point to a racial or a social cause? are they due to differences of 'nature' or of 'nurture?'

There are now living about 7,000,000 Jews; (a)[1] 98.9% of these are Jews both by birth and by religion; (*b*) 1.1% are Jews by religion only, and (c) 2% by birth only. The last two classes are important anthropologically, but reliable information about them is wanting. In the Jew whom we know, racial and social influences have been working hand in hand, and the problem of separating them is unusually difficult.

From his former studies, Mr. Jacobs takes the following statements: 1. Jews have a less marriage rate, less birth rate (both due largely to the less mortality of Jewish children) and less death rate than their neighbors. 2. They marry earlier. Cousins intermarry more frequently, perhaps three times as often. 3. Jews have larger families, though fewer plural births. Mixed marriages with foreign races are comparatively unfertile. 4. Among Jews male births are more frequent, still births and illegitimate births less frequent than in the average population. (Amongst the illegitimate births the proportion of still-births is not less.) 5. Jews have a smaller mortality of children under five. (Not true of Jewish illegitimate children.) Deaths over 60 are more frequent; suicides are less frequent than normally. 6. Their claim to immunity from certain diseases (phthisis, cholera) is doubtful. They are apparently more liable to diabetes and haemorrhoids, and have proportionately more insane, deaf mutes, blind and color-blind. 7. A vast majority live in cities. They have a larger ratio of poor.

Many of these divergences are evidently of social origin, such as the frequency of consanguineous marriages, the smaller proportion of suicides and of illegitimate births. Moreover, the fact that the illegitimate do not share the advantages speaks for the importance of social influences. There remain as probably racial only four biostatical points. These are 1. the less number of twins and triplets; 2. the infertility of mixed marriages; 3. the greater longevity of Jews; 4. their alleged special liability to disease. Of the causes of (1) we know nothing; (2) is of sufficient importance to merit a review of the evidence on which it rests. In Prussia between 1875 and 1881, 1,676 such mixed marriages resulted in 2,765 children, an average of 1.65 per marriage; while the average for pure Jewish marriages was 4.41,—*nearly three times as great*. In Bavaria (1876–80) 67 such marriages showed an average of 1.1 against 4.7 for pure Jewish mar-

[1] This class is formed of (1) *Ashkenazim* or German-Polish Jews, forming 92.8% of the whole, and (2) *Sephardim* or Spanish-Portuguese Jews 6.1%.

riages. The statistics of sterility show a similar result.

The evidence for the greater longevity of Jews is not so unequivocal as is usually supposed. Their insanitary mode of life,[1] weak constitution, greater proportion of men unfit for military service, would not indicate any such advantage. Social influences favoring longevity are their pursuit of rather long-lived trades (tailoring excepted); greater care of Jewish women; the tranquilizing effect of their religion and family life, and so on. Mr. Jacobs does not lay much importance on the effect of the observance of the dietary laws. They do not secure immunity from disease. Finally, their liability to special diseases requires further evidence. Keeping in mind the reciprocal influence between nature and nurture, we can conclude that the biostatical peculiarities of Jews are social, and only secondarily racial, and 'cannot therefore be adduced to show common origin.' If by 'Jewish' we mean properties due to origin, and by 'Judaic' those due to religion and custom, then their biostatics is Judaic, not Jewish.

COMPOSITE FROM FIVE PHOTOGRAPHS OF JEWISH BOYS.

THE FIVE COMPONENTS OF THE ABOVE COMPOSITE.

Jews are shortest and narrowest of Europeans (Moyars perhaps are shorter). Their height is 5 ft. 4 in.; girth 31.6 inches. The importance of social influences is seen in the measurement of 130 English Jews of the better class, whose average height was 5 ft. 7 in., and girth 35.2 inches. As to shape of head they are brachycephalic, or short-headed, the cephalic index being 83.4. They have fewer blue and gray-eyed individuals, and more brown and dark-eyed, than their Teutonic neighbors. So also their hair and skin are darker. The statistics on color-blindness are unanimous, making three Jewish children so afflicted where only two would be found in other races. The common notion as to length of nose is supported by measurements, while that of the thickness of the lips is not.

At the instance of Mr. Jacobs, photographs of boys from the Hebrew free school of London were taken with almost no selection, and from these Mr. Galton prepared composites according to his well-known process. 'They were children of poor parents, dirty little fellows individually, but wonderfully beautiful as I think in the composites,' says Mr. Galton. He adds that they are the best specimens of a composite that he has ever produced. There are two sets of the composites, one giving full face, the other profile views. Two groups of five separate photographs accompany the composites, as also a co-composite of the two composites thus formed. A fourth composite formed from photographs of Jewish young men is also given. The printing of the components along with the composites makes this contribution to composite photography especially valuable. Of the faithfulness with which they portray the Jewish type there is no doubt. An artist found in one of them a realization of his ideal of Spinoza when a lad. Mr. Jacobs thinks that here we have the nearest representation of the lad Samuel, or the youthful David. He also identifies the features of the captive Jews of Lachish in the Assyrian *bas relief* (B. C. 701) with the modern features, thus showing the persistency of the Jewish type. 'If these Jewish lads, selected almost at random and with parents from opposite parts of Europe, yield so markedly individual a type, it

[1] Particular reference is here made to their overcrowded life in Ghetti, where 266 houses averaged 29.3 persons per house.

can only be because there actually exists a definite and well-defined organic type of modern Jews.'

A few words as to the characteristics of the face. It is not so much the common notion of the length of nose, as the flexibility of the nostrils that is Jewish; the mouth is large 'with ends well marked and pouting underlip, heavy chin and broad forehead;' 'large brilliant eyes set closely together, with heavy upper and protuberant lower lid, having athoughtful expression in youth, transformed into a keen and penetrating gaze by manhood.'

Considering the question historically, Mr. Jacobs in opposition to Dr. Neubauer whose paper was read just before his own, as also to Renan, holds that the evidence shows in favor of the purity of the race. The main points are these: The foreign element due to proselytism has been exaggerated through neglect of the consideration that only one small class of these—the Proselytes of righteousness had the full *jus connubii*. The strong penalty attached to such marriages in early days, the seclusion in ghettos, the natural aversion on both sides, the existence of the *Cobanim* (about 5% of all the Jews) who could not marry outside the race at all, all tend to reduce the foreign element considerably. Again, in all species the male varies more than the female; when this occurs we probably have a species. Jewesses do vary very slightly as compared with Jews. (Mr. Jacobs suggests a composite of Jewesses). Finally, granted that a certain foreign element is mingled with the race, even as much as 1-10 of the whole number; then owing to the difference in fertility of mixed and purely Jewish marriages, at the end of 200 years the 1-10 would have diminished to 1-50; where the tendency of reversion to the Jewish type has yet to be taken into account. For all these reasons the long-standing belief in the substantial purity of the Jewish race may hold its ground. J. J.

REFORM IN OUR CALENDAR.

In *l'Astronomie* for August, M. Jules Bonjean discusses proposed changes in our method of reckoning time which would be advantageous. He would leave the seven-day week and the 365 or 366-day year of the Gregorian calendar as they are now; but he takes strong ground—and in this all can sympathize with him—against the present arbitrary and inconvenient grouping of days into months. He would reform it by making January have 30 days, February 31, March 30, and so alternating through the year till December, this month having 30 days in the ordinary year of 365, and 31 in leap year. No one can dispute the much greater simplicity and convenience of this. Then he would always have the year begin on Sunday, and in consequence have an extra Sunday, or a holiday, for the 365th day, and in leap year two of them. He argues in favor of thus having the same day of any particular month always come on the same day of the week, and also having an extra day—and, once in four years, two—come during the world-wide period of festivities attending the Christmas and New-year holidays. There can be no question that some such plan would possess many advantages over the present arrangement. Of course it does away with the week as a continuously periodic measure of time, but practically it is never used for that either in civil or astronomical reckoning, but simply for the temporarily recurring period of rest or religious observances, and for this a break once per year is of no importance.

There is one point, however, in which it seems, to the writer, that M. Bonjean's plan might be slightly improved. Respect for religious observances would, no doubt, demand, throughout the greater part of the civilized world, that there should be 52 Sabbaths in the year; and such observance of Sunday as the first day of the year might clash with the peculiar social or civil ceremonies which either already, or in future might, very appropriately belong to the opening day of the new year. It would seem more appropriate to have New-year's day a world-wide holiday, to be celebrated by each nation as suited it the best, and then let Sunday, the New-year Sabbath, fall on January 2. The relative merits of the two plans are best seen below, where the 12 or 13 days at the end of the old and at the beginning of the new years are arranged with the two plans side by side, the two middle columns of dates referring to either one:

	Bonjean's Plan.	Day of the year.	Day of the Month.	2d Proposed Plan.	
Holiday season.	Saturday	357	Dec. 22	Friday	
	Sunday	358	" 23	Saturday	
	Monday	359	" 24	*Sunday* Christmas.	
	Tuesday	360	" 25	Monday	
	Wednesday	361	" 26	Tuesday	
	Thursday	362	" 27	Wednesday	
	Friday	363	" 28	Thursday	
	Saturday	364	" 29	Friday	
	Annual holiday	365	" 30	Saturday	
	Leap-year holiday	366	" 31	Leap-year holiday	Holiday season.
	Sunday and New-yr day	1	Jan. 1	New-year holiday	
	Monday, 1st business day	2	" 2	*Sunday*, New-year Sabbath	
	Tuesday	3	" 3	Monday, 1st business day	

With such a change in the calendar we can have a regular annual Christmas Saturday, Sunday, and Monday. Saturday for shopping, Sunday for the churches, and Monday for Christmas trees and giving of presents. Our own national holidays of February 22 and July 4 would fall, in M. Bonjean's plan, on Tuesday and Thursday respectively, and in the second plan upon Monday and Wednesday. H. M. PAUL.

SCIENCE.

FRIDAY, OCTOBER 9, 1885.

COMMENT AND CRITICISM.

IF A REPUTATION for truthfulness, where the truth can be learned, and for plausibility, where things have to be guessed at, is of any value to a newspaper, the attention of our journalists should be called to their Washington news. We recently alluded to a supposed report to the first auditor, made by a committee which had been investigating the geological survey, and filled with a very detailed account of illegal proceedings in the work of that bureau. A pretended abstract of this report was telegraphed to the New York *Times*, of Wednesday, Sept. 16, to the Boston *Advertiser*, and perhaps to many other journals. We showed the report to be a clumsy fabrication on internal evidence. It now turns out that not only the report, but the committee itself, was purely imaginary. No such committee ever existed, and, of course, no such report was ever made by any responsible authority. The latest news is that, so far as Auditor Chenowith has examined the accounts of the geological survey, he has found no illegality in its expenditures.

Coupled with the statements are certain alleged utterances of the auditor of such a character, that a suit for libel on his part ought to lie against the newspapers which have put them into his mouth. For example, that 'these gentlemen,' the scientific employés of the survey, would be required by him to do only such things as common people could understand. Apart from the calibre of mind which would be displayed by such a remark, the very act of attributing it to the auditor shows an ignorance of the duties of that functionary, which ought not to be tolerated in a Washington correspondent, unless, indeed, knowledge is regarded in his case as a disqualification by reason of its acting as a drag upon the flights of his imagination. At the risk of diffusing unwelcome knowledge, we will point out that the functions of an auditor are only those implied in his title. It is his duty to see that all government expenditures, which he is charged with auditing, are made in accordance with the laws governing them. If he finds that an officer is spending money for any other purpose than that stated in the law which appropriates it, that he is paying extra salaries to employés, that he is employing more or other men than the law allows, or is in any other way deviating from legal requirements in his expenditures, he must stop him. But it does not concern the auditor whether an employé does, or does not, receive pay from an institution of learning, for the simple reason that there is no law against the officers of such institutions being employed in the government service. Nor can he inquire how an officer is employed, or whether his services are worth the salary paid him. All such questions as these belong to the head of the department to which the officer belongs, and it is for the Secretary of the interior alone to decide whether college professors shall be employed in the geological survey, and whether they shall do anything which common people cannot understand. The newspapers have, therefore, represented the auditor as usurping the functions of the Secretary of the interior.

Indefinite hints have now and then been given out that there was something wrong with Professor Baird's fish commission. Nothing has officially transpired except a brief correspondence with the auditor about the legality of erecting a 'residence building' at Wood's Holl. Professor Baird explains that this building was not erected, as the auditor seemed to infer, merely as a residence for the officers of the commission, but for the general work of the commission, and was called by the objectionable name because it contained the quarters necessary for the officers during the performance of their duties. One feature of this case has been entirely overlooked. Professor Baird's duties as fish commissioner are entirely gratuitous, as he receives no salary whatever from the government proper. The salary of the secretary of the Smithsonian institution is paid from the income of the Smithsonian fund, of which the government is the trustee, not the owner. We believe it contrary to sound principles that the government should ask or expect this class of services to be gratuitous. So long as

they are, the public will look with great lenity on the donor providing himself and his co-laborers with the necessary shelter, while they are engaged upon their professional duties.

At a meeting of the Brookville society of natural history, Sept. 22, a committee was appointed to confer with the scientific associations, educational institutions, and with individuals throughout the state of Indiana, concerning the advisability of the formation of a state academy of science, and if thought advisable, to coöperate with such persons in favor of the formation of such an association. Free expression of opinion is called for by the committee, both as to the need of such an organization and as to the best plan for its composition. It is now the plan to hold a meeting at Indianapolis between Christmas and New Year's day. It proposed that the organization shall enable the citizens of Indiana who are engaged in scientific work to meet at certain times "for social intercourse, for the exchange of ideas, and the comparison of results of scientific studies." It would appear from the prospectus that the academy would be a state society similar to the American association.

We are informed by Prof. Chas. A. Bacon, director of the Beloit college observatory, that the statement made in *Science* for Sept. 4, that the observatory had been closed on account of lack of funds, is incorrect. Professor Bacon states that, on the contrary, new arrangements have been made for carrying on additional observations in meteorology, and that especial attention will be paid to solar and spectroscopic work with greater facilities than before.

In The *American meteorological journal* for September, Dr. Daniel Draper, director of the Central park meteorological observatory, asks the questions, What is ozone? and Can ozone produce pneumonia? and he gives, for the months of January, February, March, April and May for each year from 1878 to 1885, the death rate from pneumonia for New York City, and the figures expressing the amount of ozone and the number of days on which it was present in the atmosphere, as shown by the continuous records of his observatory. The coincidence of the curves indicated by the sets of figures—though possibly only accidental—yet seems sufficient to warrant further investigation of the matter, and would seem to call upon chemists to join now with physicists—who are making a special study of atmospheric electricity—to see if they can further clear up the doubtful relations between oxygen, ozone and electricity, and, perhaps, discover a simpler and more reliable method than the present, by which ozone tests or observations can be regularly made by meteorological observers.

THE PRESIDENT AND PROFESSOR AGASSIZ.

When it became known a few days ago that the President had invited Professor Agassiz to assume the direction of the coast survey, there was great satisfaction among those who desire that the principles of good government should be applied to the scientific bureaus as well as to the other executive offices. The independent position of Professor Agassiz, his administrative ability, and his acquaintance with the state of science in this country are so obvious, that even those who believe as we do, that a person trained in mathematical and physical science should be the head of the survey, must have seen that in the emergency Agassiz was a very felicitous choice. The announcement that he had been selected by the President for this responsible station was an assurance that the administration desired a man of unsullied name and of unquestioned ability to guide the affairs of the coast survey in the embarrassments which they have encountered. It removed the apprehensions which have been entertained that scientific work will not be encouraged by the party in power. It showed that the President and the Secretary of the treasury, in the difficulty which has arisen, are not indifferent to the survey, but are sincerely desirous of placing it under the direction of an able man, whose name and character would be the guarantee of success.

The health of Professor Agassiz precludes his acceptance, but he has another reason for refusing the office in question. In his opinion, the guidance of the coast survey requires an expert. The problems to be decided, the methods to be employed, the men to be engaged, should be determined by one who knows the business. Any other person would be in danger of failure. The culture of Agassiz is so broad and his experience has been

so varied, that he would have been an admirable man for the emergency, and even as a permanent head would have shown many admirable qualities. Nevertheless he is doubtless right in saying that four men can be named, two already in the government service, and two not so employed, who are qualified for the post by their acquaintance with the precise investigations which are prosecuted by the survey. One of these he hopes will be appointed.

From all that reaches us, we are persuaded that neither the President nor his advisers are hostile to the proper prosecution of the government work in science. If abuses have crept into any department, these abuses will doubtless be eradicated. As the corrections proceed, undue zeal may sometimes be shown by the subordinate reformers; individuals may neglect the considerations of courtesy and the deference due to those whose lives have been devoted without reproach to the service of the country; but the correspondence of Secretary Manning and Professor Agassiz is to us an assurance that science will not be retarded, and that scientific men will not be slighted by any act of President Cleveland.

BULGARIA AND BULGARIANS.

Forty-three years have come and gone since M. Cyprien Robert wrote that: "On the confines of Europe, there vegetates, enslaved and forlorn, a nation hardly known at the present day, but deserving all our sympathy. This nation is that of the Bulgarians, which has preserved, in the hardest state of slavery, its ancient manners, its lively faith, its noble character, and, after having had a glorious past, seems destined, by its geographical position, to play an important part in the future." Few political prophets have been happier in their prophecies. Since 1842 the Bulgarians, having acquired a national church and some educational facilities, have thrown off the cloak of listless barbarism which then enveloped them, have risen against the Turks, their masters, have been secured by the strong arm of Russia, with the consent of Europe, in a position of conditional independence, and now, at last, united and aroused, seem destined to free themselves entirely from the Turkish yoke, and, in time, perhaps, to become the European successor of "that multitudinous crime which we call the Ottoman government."

One must not ascribe everything to mere geographical position. National peculiarities have had much to do with this progress, but a glance at the accompanying map will serve to show not merely the commercial importance of the country inhabited by the Bulgarians, but also that, in a purely strategic point of view, the Bulgarians hold the key to Constantinople. They may be said to inhabit an immense square, bounded on the north by the Danube from Widin to Silistria, and thence, in a direct line, to the Black Sea near Varna; on the east by the Black Sea itself; on the south by the peninsula upon which Constantinople stands, and the Ægean; and on the west by Albania and Servia. The northeastern portion of this region, however, has been colonized by the Tartars, who flying from Russian rule, soon after the close of the Crimean war, settled on the grassy plain lying to the north of the Roman wall, and between the Danube and the Black Sea. This plain, known as the Dobrudsha, soon proved too small for them, and they spread thence to the south and west for a considerable distance. Neither in strictness can the Bulgarians be said to live on the coast either of the Black or Ægean seas, as in all the towns on the sea coast the Greek holds the most important position. The Balkans divide this Bulgarian square into two unequal parallelograms, the northern of which constitutes the Bulgaria of the Berlin congress, while the southern forms the larger part of the Eastern Rumelia of the same instrument. Thus it will be seen that the Bulgarian holds the line of the Danube, the outermost defence of Constantinople; that the Balkans, with their difficult passes, are entirely within his control; that Shumla, which has so often and so prominently figured in the Russian advances, is now a Bulgarian fortress, and that Adrianople, the railroad centre of the Constantinople peninsula, lies on his borders. Besides this, Salonika, the military port of the Ægean, and Varna, that of the Black Sea, are almost at the mercy of an army having possession of the roads and the sympathies of the people of this region, even though the majority of the inhabitants of the towns themselves are inimical to the Bulgarians.

The Bulgarians of to-day resemble the other Slavic races of Europe more closely than they do the Turks or the Greeks. Yet, unlike the Servians and Montenegrins, they are not of pure Slavic descent, but are a Slavonianized race. Men learned in the languages profess to find in the Bulgarian dialect certain words and phrases which point to a Finnish origin; but there is an element, too, derived from Turkish and Persian languages; while some scholars, relying more on ethnological similarities than on philological analogies, declare the Bulgarian to be of Mongol extraction. Whatever theory is the true one, the Bulgarian differs

from the surrounding Slavic races in origin, and he has a more or less close affinity with the Russian, who has been described as a Slavonianized Finn with a dash of Mongol blood. This distinction of race is of the greatest importance as it explains, in a measure, how it was that the Bulgarian remained passive, while his Servian and Montenegrin neighbors maintained or secured their independence. Other things, however, also contributed to this result as, for instance, the banish-

A SKETCH MAP TO ILLUSTRATE CHANGES IN TURKISH TERRITORY BY THE TREATIES OF SAN STEFANO AND BERLIN.

Bulgaria, shown thus: 17,300 Geogr. sq. m.

Territory taken from Turkey by treaty of San Stefano, and restored to her by Congress of Berlin, shown by horizontal lines: 30,700 " " "

Accessions to Roumania, Servia, and Montenegro are shown by vertical lines:

ment of the old Bulgarian nobility, the nearness of Bulgaria to Constantinople, and the lack of homogeneity in the population of that country. For, although the Bulgarians put together outnumbered all other nationalities, the Turks and the Greeks (here, at least, working in harmony with their masters) formed an important element.

It is exceedingly difficult to come to any decision as to the exact place which should be given to the Bulgarian in the social scale. There is no lack of books on the Slavic provinces of Turkey, but, unfortunately, those of recent date have been written by Englishmen, and whenever an Englishman writes on any phase of the eastern question his political predilections cloud his judgment. Thus an English tory has pictured the Bulgarian as 'a lazy drunkard and a fanatical fetishist,' while declaring, almost in the same breath, that the Turk is 'honest, sober, industrious,' and, furthermore, asserting that the 'purest family love exists in the harem as much as in any household of Europe.' The liberal, on the contrary, regards 'Turkish home life' as something to be avoided, and asserts that drunkenness is rampant among the Mussulmans, and that any Turk would murder a Christian for a few piastres. The Bulgarian, on the other hand, in the eyes of the English liberal, if not possessing all the virtues, is 'very industrious, penurious, and, although rather apathetic as a workman and employé, is to be preferred to all others.' The truth undoubtedly lies between the two extremes. It was the fortune of the present writer to pass a few days in Bulgaria some six years ago, to see a good deal of its inhabitants, and to have many long and interesting conversations with some western Europeans who were then employed on the Varna railway. The conclusions which have forced themselves upon him are at variance with those reached by the English tory.

In times past, and even at present, the Bulgarians might be called a superstitious race, but so might others nearer home; and it should always be remembered that until recently the Bulgarian had few educational advantages, except those afforded by our own American missionaries, who not only

many of them to read and write, but placed ble and some good school books within their

Then, too, the Bulgarian church dates only 870. Before that time the hated—and who lly deserved to be hated—Greek priest was y religious adviser, and such being the case ferred to go without religious ministrations. ulgarian drinks no more than do those about other races. He is fully as honest as they, to tell the truth, is not saying much for his y, and, when any incentive is offered, is as in- us—excepting, perhaps, the Crim Tartars, em to be an extraordinarily industrious race. e Bulgarian is eminently superior to the Turk ek in his capacity for improvement, which is ly very marked. Then, too, though sur- d by Slavic races, whose immorality is us, the Bulgarian woman—though pro- by none of the safeguards which the Turks around their women—is above reproach; this account mainly Bulgarian home life is ing almost unique in the east. The village s an entirely different being from the Moslem nboul, in that he is honest and industrious, the same time he is susceptible of little or rovement. The future of the Balkan pen- seems to lie in the hands of the Bulgarians, is undoubtedly the knowledge of this that the Greeks so restive at the threatened of all the Bulgarians.

re is no room here to go into the causes of te Russo-Turkish war. By February, 1878, ussians had passed the Balkans and had their lines tightly around Constantinople. rch 3, the negotiators of the two powers ir hands to a treaty of peace at the little of San Stefano, ten miles from Stamboul, are many points worthy of notice in this but what concerns us at the present t it is the disposition that was made of the ians. By this treaty of San Stefano, that the Balkan peninsula lying between the e, the Black and Ægean Seas, Albania and was formed into a great tributary state to d by a Christian prince chosen by the Bul- themselves, in whose hands should be the stration and military police of the state, and on was made for representative institutions to those of Roumania. The Turkish garri- ere to evacuate the country, which was to be d for two years to the fostering care of a n commissioner and 50,000 Russian soldiers. ourse England, then ruled by the Beacons- vernment, could not calmly stand by and sia acquire such a predominant position at es of Constantinople. Explanations were ded, money voted, the reserves called out, and war seemed almost begun when it was agreed to refer the matter to a European congress. The congress assembled at Berlin on June 13, 1878. A month later the Berlin treaty was signed. The map in the text will show the territorial modifications of the San Stefano treaty which were thus brought about. Servia and Montenegro, with considerable accessions of territory, were declared independent. Bessarabia, torn from Russia after the Crimean war and then given to Roumania, was restored to Russia, which now once again extends to the Pruth and the Danube. Roumania, which was declared independent, was recompensed with the Dobrudsha, Bosnia and Herzegovina were turned over to Austria, and the Porte was recommended—afterwards compelled—to give large portions of Epirus and Thessaly to Greece. The great Bulgarian state which Russia had endeavored to erect at the outposts of the Turkish capital was divided into two states. That north of the Balkans to retain the name of Bulgaria, and to have an elected Christian prince, and to be tributary only to Turkey. That lying south of the mountains to be governed somewhat like an English colony, and to be called, not South Bulgaria, for that might arouse national aspirations, but Eastern Rumelia. The internal police of this partially independent or conditionally autonomous province was to be in the hands of a native militia, and the Turkish army could not be sent into the province unless to suppress an insurrection or the like, and then only on notification being given to the 'powers.' The Ottoman government was to garrison the Balkan fortresses, which right, however, it promised not to exercise.

On the whole, the Berlin arrangement has not worked well in practice. Naval demonstrations and armed occupations have been necessary to compel its observance. On the 18th of last September the Bulgarians of Philippopolis—the capital of Eastern Rumelia—rose in rebellion and proclaimed a union of Eastern Rumelia with Bulgaria. Bulgaria accepted the union, and if Prince Alexander can maintain himself, the Berlin treaty will have been pierced in its most vital part. In closing this brief account of one phase of the eastern question, I am reminded of what Mr. Gladstone wrote of the "heartless manner in which the statesmen of a by-gone generation have argued for the maintenance of the Ottoman gov ernment with a view to the general convenience of Europe, while they have seemingly omitted from the case all consideration of the question, how far the Porte fulfilled or defeated the main purpose for which every government exists—namely, the welfare of those beneath its rule." The present crisis is merely the attempt of one of the subject

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"I am asked by the government to inform you that, in acknowledgment of the excellent performances of the great Alexandrian, furnished for Pulkowa by your firm, his majesty, the Emperor, has been graciously pleased to confer upon you the golden honorary medal of the Empire. The value of this gift is enhanced by the circumstance that this medal is given very rarely and only for quite extraordinary merits. You and Repsold are the first who will receive it from the present Emperor, Alexander III.

"The circumstance produces some delay in the transmission, as the Emperor desires that the medal shall bear his portrait, and not that of his predecessors. Therefore the stamp must be newly engraved. When that is done, you will receive the medal through the Russian minister at Washington.

"When this letter reaches you I shall be on a journey through Germany and Switzerland. First I shall assist at the general meeting of the Astronomical association, at Geneva, and then must go for a cure to the well-known watering place, Carlsbad. Though my health is tolerably good at this moment, I feel still very tired, and from the illness of last winter there is left some affection that demands serious treatment.

"You will be pleased to hear that, with the 30-inch refractor in good nights all the most difficult double-stars, discovered by Burnham with the Washington refractor, can be easily measured. During the last weeks, Hermann has collected already some hundreds of measures on similar objects that were out of the reach of the old 15-inch refractor. . . . . OTTO STRUVE."

Pulkowa, July 28.

WEST AFRICAN ISLANDS.

MAJOR ELLIS, known as the author of 'West African sketches' and other works, has accumulated the notes for this volume during a residence of several years on the West Coast of Africa, and has prepared,

during some fifteen voyages along the south and west coast of Africa. This book would be supposed from its full title to be a geographical or statistical work from a military point of view. It does indeed present facts of this character, but also much more. Written in an easy and unassuming style, the author has skilfully combined with an account of the chief geographical and economic features of the islands, a description of their attractions, their peculiarities, their odd or extraordinary inhabitants, and a great variety of extremely amusing anecdotes. We believe those of our readers who may be led by this notice to peruse it will find themselves abundantly repaid.

St. Helena is first described, rather briefly, as already much written about; then follow Ascension, Fernando Po, the Isles de Los, St. Vincent, San Antonio, Goree, Grand Canary, Teneriffe and Madeira. Some information of a strictly veracious character will also be found in regard to the miraculous island of St. Brandan.

One of the most singular spots is the Island of Ascension, which belongs to the British Admiralty, and is enrolled in the list of ships in commission under the title of 'the tender to H. M. S. Flora.' This originated in the fact that a vessel of that name was once anchored off the island as a storeship, and part of the stores were kept on shore. Naval discipline is maintained, but a few ladies, wives of the officers exiled to this barren spot, are allowed to remain here, submitting to naval routine, which includes all lights out by 10 P. M. There is no water except intermittent collection of rain or dew, insufficient for the needs of the inhabitants. Nothing can be cultivated, though a few green things grow on the peak of one of the higher hills and in some narrow ravines which concentrate the scanty dews and showers. Sea turtles and terns, locally known as 'wide-awakes,' are the sole edible productions. Cows are brought there, and at first supply a small quantity of milk, which is reserved for the hospital. Should there be a surplus it is sold, a bell being rung to announce the event, but nobody is allowed to buy more than one gill. After a time the milk dries up and the cow is turned into beef to save her from starving to death.

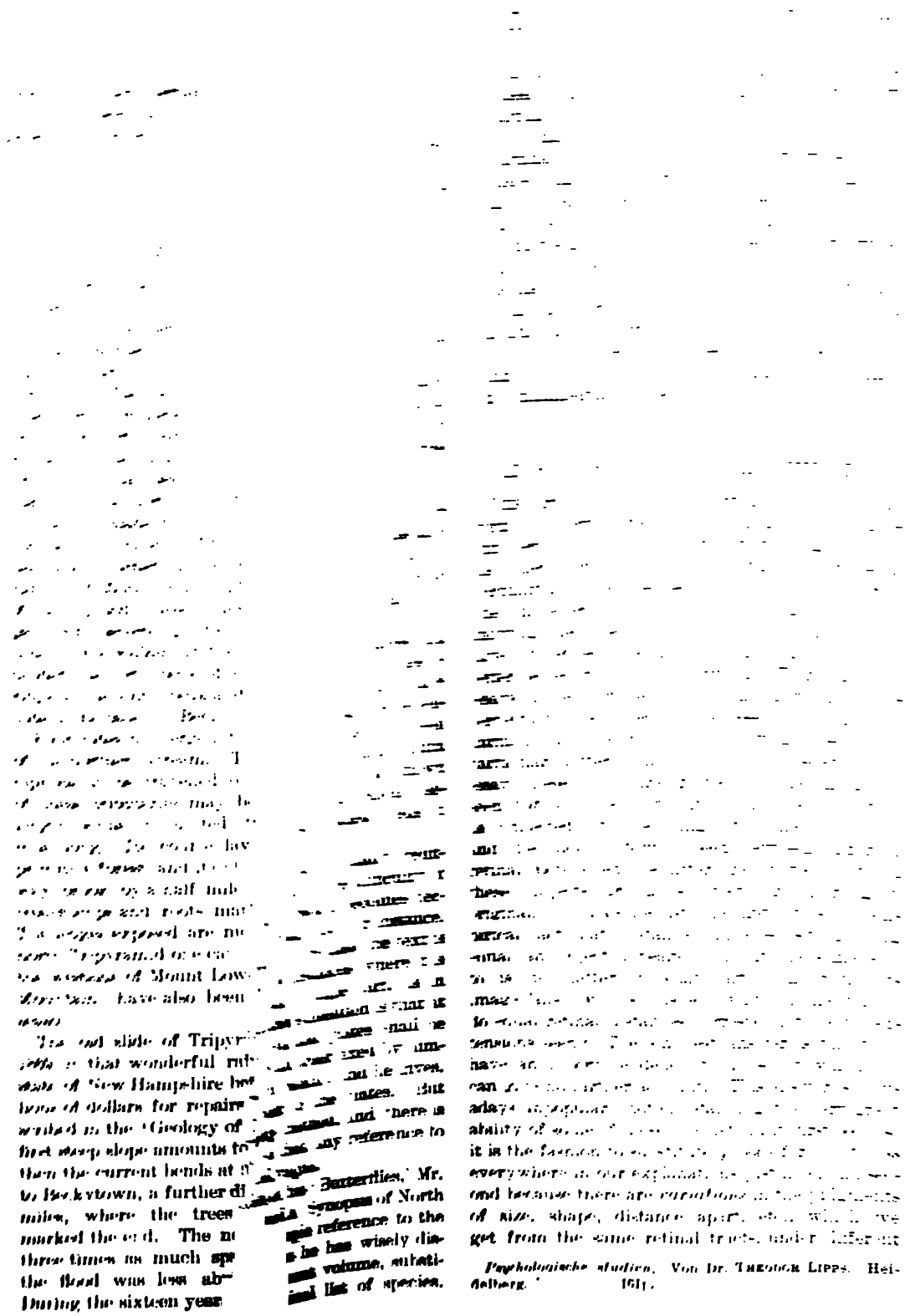
An American returning to England on the same steamer with Major Ellis, went ashore to look at the island, and came near running against an officer with flaxen whiskers, who suddenly issued from a building. The officer raised his eye-glass, looked at the stranger with astonishment, and before the latter could apologize, called out: "Simmons!" A bearded seaman responding, "Ay, ay, sir," appeared upon the scene. The officer continued: "Simmons, do you know what this person wants, or who he is?" "No, sir; I can't say, I'm sure, sir." The American began to explain: "Sir, I am a citizen of the United——" when the naval man interrupted him and said: "Simmons, do you think he is a stowaway?" "Can't say, sir, I'm sure," replied the imperturbable Simmons. "Is there a merchant steamer at anchor there?" "Yes, sir, Cape mail, sir." "Well, Simmons, just go to the officer of the watch, and ask if he has given permission to any person to board us. And, er—, see what this person wants." The American, now very angry, began again: "Sir, I am——" when he was again interrupted by the officer: "Simmons, I am engaged now. I cannot see this person. Perhaps you had better take him to the officer of the watch." And he went off before all the terrors of the United States could be launched upon his head; while the seaman, grinning respectfully, when his superior's back was turned, conducted the irate Yankee to the officer at the landing place, with whom he had but just come ashore. Sociable fellows, our British cousins, even on a desert island!

West African Islands. By Major A. B. Ellis. London, *Chapman & Hall*, 1885. 8+352 p., 8°.

EDWARDS'S BUTTERFLIES OF NORTH AMERICA.

The perseverance with which Mr. W. H. Edwards has continued his study of the butterflies of this country, and the liberality with which he has illustrated their various forms, ever since he first began the task, are worthy of all praise. The completion of his second series furnishes occasion to draw attention to its excellence. When Mr. Edwards first advertised, in 1868, that he would attempt a complete work, with ample illustrations, on the butterflies of North America, he probably little understood the nature of the task before him, or foresaw into what fields his work would carry him. Notwithstanding all he has accomplished, the horizon, broadening with his work is as distant as at the start. At first his iconography was almost exclusively given up to the mere description of species, with no attempt to illustrate anything but the perfect insect. Indeed, the work proceeded for nearly three years before the first illustration was given of the earlier stages of a single butterfly. Since that time but a single number has appeared which did not contain one

The butterflies of North America. By William H. Edwards. Second series. Boston, *Houghton, Mifflin & Co.*, 1874-1884. [445 p., 51 pl.] 4°.



Psychologische studien. Von Dr. Theodor Lipps. Heidelberg. 1611.

circumstances, and these variations seem often in a singular way to conform to what they would be like if the retinal excitements acted on the mind by *suggesting* space determinations learned in some other way. Even should the retinal tracts have innate feelings of extension of their own, the variations in question force us to admit that the innate extensions etc., are often overpowered by the suggestion of other and different ones. Thus the nativistic school of explanation is replaced by the 'empiristic' school, as Helmholtz calls it. The experiences, whose suggestions prove themselves to be so much more powerful than anything else, are, for these authors, on the whole, experiences of *motion*. The movements of the eyeball are the *deus ex machina* which shall solve all riddles. The excessive intricacy and delicacy of the facts to be interpreted can be estimated by the differences of opinion that still exist among the interpreters—many of them men of as great ability as our century has shown in any intellectual field. Dr. Lipps now rushes into their midst, and deals blows against the whole movement-theory that ought really to warm the hearts of its doubters. Whatever it be that measures off the field of view and establishes directions and distances between the impressions we get from retinal points, it is, according to him, neither muscular sensation nor feeling of innervation,—it must be something else. Let us say here, that however it may fare with Dr. Lipps's positive theories, this critical onslaught of his is a permanent achievement from which it will be hard for the muscle-theory to recover. 'Feelings of movement' and 'unconscious inferences' have too long run riot and had it their own way in the philosophy of vision. Being more or less hypothetical entities, one may construct very much what one pleases with them, and hitherto they have turned a deaf ear to critics. The champions of the feelings of movement can, however, hardly ignore Dr. Lipps's manner of calling their protégés to account.

Dr. Lipps's own theory is nativistic to the extent of admitting that if ever retinal impressions are discriminated at all, their difference will (by an inexplicable law) appear as a difference of position. It is however 'empiristic' first, in that it assumes that no discrimination would occur at all unless differently colored extended *objects* were what excited the retina in the first instance; and second, in that it makes the *average extension of the objects* determine the extension at which the various excited retinal points shall appear to us apart. Adjacent points everywhere on the retina are more likely to have a portion of one object than the boundary of two objects cast upon them. Distant points are more likely to be excited by different objects than by the same object. Distant points will tend then rather to be discriminated; adjacent points rather to remain fused together. The object-experiences of intermediate points will have helped partly to separate them, partly to keep them together. The author seems to think that with a greater tendency of two points to be discriminated will go a feeling of their greater, and with a lesser tendency, a feeling of their lesser, distance apart—a point which he has not made theoretically sufficiently clear.

The tendency to be fused together until discriminated is for Dr. Lipps fundamental. That the borders of the blind spot should give images that are fused, and run into each other, that are without breach of visual continuity between them, is nothing peculiar. Every part of the retina is similarly continuous with every other, even distant, part. We *see* then space *continuous* over the blind spot. How *much* we see there is determined by the general law of discrimination. The two borders of the spot receive images sometimes of the same, sometimes of different objects, and the balance of their tendencies to fuse and separate is what will determine their apparent distance apart. A close study of the actual phenomena of the blind spot is apparent in this section.

The section on the perception of the third dimension, depth, or distance, is properly an expansion of Ferrier's commentary on Berkeley. Berkeley said we cannot see distance. Ferrier, the metaphysician, said we can *see* space only between two things both of which we see. We cannot see our own eye; *ergo* we cannot see the space between it and anything else. But such space is what is meant by distance; *ergo* we cannot see distance. Dr. Lipps enforces this by the most remorseless logic, denying that there *is* any properly so called visual *perception* of the third dimension at all. There is merely a conceptual *knowledge* of it. He makes a brave attempt to explain away the apparently direct sensational character of this knowledge, as when we look, for example, into the stereoscope; and he makes a heavy attack on Stumpf as the ablest advocate of a direct feeling of depth. He carries the discussion to a point, as it seems to us, where it becomes largely a matter of words. To admirers of Berkeley, however, it may be said, that nowhere has the original negative Berkeleian doctrine about distance received anything like such able support as this.

In the essay on musical discord, our author reverts to the old-fashioned theory of a subtle sense for the incongruity of the rates of vibrations of the notes simultaneously heard. He shows by an interesting experiment how hard it is to hear one rhythm made outside of us, and to carry on a differ-

ent incommensurate rhythm ourselves, whether by movement, or inward time keeping. Helmholtz it is known explains discord by '*beats*,' harmony by their absence; and melody he explains by the 'affinity' of the consecutive notes, *i. e.*, the presence in them of identical over-tones. All these theories Dr. Lipps denies, to touch the essence of the matter; and reduces harmony, discord, and melody to the single positive principle of felt congruence or incongruence of vibratory rates. The paper is too technical to be gone into in more detail. All musical æstheticians should read it. It closes a little book, which, for acuteness, clearness and vigor, has not been surpassed for many a long year.

ASTRONOMICAL NOTES.

IT appears from the latest reports we have seen that the new star in the Andromeda nebula (31 Messier) to which attention was first generally called by Hartwig's telegram, was discovered independently by several observers, one at least antedating Dr. Hartwig. Dun Echt Circular No. 98 announces that it was seen by Mr. Isaac W. Ward on August 19, and by M. Lajoye at Rheims, August 30. Baron von Spiessen at Winkel, in Prussia, seems to have noticed it on the evening of August 30, about 9½h., communicating his observation to Dr. Deichmüller by mail. On August 31, at 10h. 20m. Berlin mean time (before the arrival of Hartwig's telegram), Dr. Oppenheim turning his 3½ inch comet seeker upon the nebula, noticed the new star-like nucleus and estimated it to be between the 5th and 6th magnitude. The new star was also independently discovered by G. W. Middleton, at Mexbro' Common, England, on September 3. Hartwig telegraphed the peculiar appearance of the nebula from Dorpat at 10h. 15m., August 31. We have the testimony of different observers that the star was not there in the early part of August. Hartwig estimated it at 7th magnitude on August 31, Oppenheim making it 5th to 6th magnitude, and Lamp 7.4 magnitude on the same evening. On September 1, and for several days following, it was variously estimated from the 6th to 7th magnitude, and since that time it has gradually grown fainter, the latest estimate (by Mr. Skinner, with the transit circle of the naval observatory, September 30) making it of about 9½ magnitude. On September 2 it was reported visible to the naked eye. In color it was called red and orange during the first week in September, but it now appears nearly white. We learn from the *Athenaeum* that Mr. Maunder examined the star with the large spectroscope of the Greenwich observatory, describing the spectrum as of precisely the same character as that of the nebula, *i.e.*, it was perfectly continuous, no lines either bright or dark being visible, and the red end wanting, so that there is at present no evidence of any outburst of heated gas, as was the case with the star T Coronae in 1866, and Nova Cygni in 1876.

The Andromeda nebula, though probably composed of a great number of very small stars, has never been resolved. The spectroscope seems to show that it is not gaseous. Assuming that the nebula is stellar in nature, and that the 14th magnitude is the upper limit of any one of its component stars, then a rise from the 14th to the 7th magnitude indicates an increase in brightness of 631 fold, which renders it very improbable that the star is one of the constituent parts of the nebula. It seems rather more probable that it is a variable or new star which happens to be in line with the nebula as seen from the earth.

The following observations of the *Nova* were made with the transit-circle of the naval observatory, and, by permission of the superintendent, are herewith communicated. The estimates of magnitude are differential with respect to the star $W^2\ 0_h$, 969 which follows the *Nova* about 2m., and is assumed to be 9.0 mag. Photometric observations of this star would be desirable:

Date. 1885.	Observer.	Magnitude.	1885.0					
			α			δ		
			h.	m.	s.	°	′	″
Sept. 17	W.	9.1	0	36	26.86	+40	38	12.5
" 23	P.	9.5			26.84			14.7
" 24	W.	9.6			26.87			12.8
1885.727		9.4	0	36	26.86	+40	38	13.4

Professor Pickering, in the Proceedings of the American society of psychical research (see *Science* vol. vi., p. 155) finds, from discussing a large number of observations, that the knowledge of a catalogue-magnitude of a star on the part of a recorder appears to exert through the medium of 'thought-transferrence,' no influence upon the independence of the observer's estimate of the same.

For the floating dome of the observatory at Nice it is proposed to employ a solution of chloride of magnesium of a density of 1.25, which will not freeze down to—40° C.

Comet 1885 II (Barnard). A conjecture having been expressed by Faye and Krueger that Barnard's comet might be periodic, Dr. Lamp, of Kiel, has computed elliptic elements and finds a period of 8,700 years. He remarks, however that, owing to the uncertainty in the single observations employed, his results can hardly be considered decisive, and the orbit may yet turn out parabolic.

GEOGRAPHICAL NOTES.

THE Italian corvette Vettor Pisani, commanded by G. Columbo, recently completed a three years' circumnavigation of the globe, with a suitable outfit and instructions for scientific hydrographic and biological work. The vessel left Italy early in 1882, provided with the most improved apparatus for sounding with wire. The officers to whom zoölogical work was entrusted were specially instructed at the Naples zoölogical station in the methods necessary for making satisfactory collections. The regions visited included both coasts of South America, from Pernambuco on the east, south to Magellan Straits, and north to Panama, the Galapagos and Hawaiian Islands, the China, Indian and Red seas, and so home. The results of the voyage are very satisfactory, many deep sea soundings having been taken, numerous charts corrected or resurveyed, general hydrographic information gathered, and a zoölogical collection accumulated which, for its fine state of preservation and preparation, is believed to exceed any collection ever made under similar circumstances.

The government of Chili has published an important work by Al. Bertrand, entitled 'Memoir on the Cordilleras and the Atacama Desert and adjacent regions,' which gives the result of explorations made during the period 1880–84, explains the system adopted, and maps on a large scale the region studied, beside giving numerous profiles. This work must form the foundation for any future discussion or description of the region acquired by Chili in the war recently terminated.

The last number of the Mittheilungen of the Vienna geographical society contains the annual summary of the president of geographical work (for 1884), beside the usual annual tables and reports. Among contributed articles is a valuable summary by Dr. Rink on the scientific work carried on in Greenland by the Danish government since 1876, and letters, nearly a year old, giving data on his last journey in Tsai-dam by Prjevalski. Breitenstein continues his interesting notes on Borneo, and especially on the Dyaks.

In the Bulletin of the Geographical society of Lisbon for 1883, but just distributed, Coelho has a long article on the chants and songs of Portuguese children, which have been collected by Senors Pires and Sequeira Ferraz. These have not only an ethnic interest for the anthropologist but the longer songs embalm fragments of popular tradition which have been sung by children without essential change from a very dim antiquity. Some of them are known to have existed in their present [illegible] as the 18th century. Probably the [illegible]erian Peninsula has remained less affected by the progress of civilization than that of any other area of equal extent inhabited by civilized man, and for this reason investigations into such topics are likely to have especial value.

The numbers of the Bulletin for 1885 contain articles on African exploration and on the island of Timor. Figueiredo also has an article on mediæval Portugal, with an excellent and interesting reproduction of a panorama of Coimbra as it appeared during the last quarter of the 16th century.

Some time since (*Science* No. 110) we referred to a journey by Mr. Richards of the east-central African mission in October, 1884, from Inhambane to the Limpopo River. The chief settlement of a tribe called Amagwaza, the town of Baleni was one of the localities sought, but want of time prevented the traveller from reaching it. We learn from the *Missionary herald* for September that on a second journey by Mr. Richards, beside visiting a large and hitherto untravelled area, was successful in reaching Baleni. He left Delagoa Bay on foot April 20, attended only by a Zulu convert and three porters. The Komati River, two hundred yards wide and thirty feet deep, was crossed about a day later in a 'dugout' canoe, and its course was followed for several days through unhealthy marshes swarming with insects. The river abounded with sharks, crocodiles and sea-cows. Leaving the river on the fourth day, a series of thirteen lakes was passed. Though there was no connecting stream at that season, the natives call this string of lakes the Liputa River, but there are often hills and bushy districts between the lakes. The country was hilly. On the seventh they emerged from the bush close to the Limpopo, and here Baleni was situated. Herds of cattle were visible in every direction, and clusters of small huts were very numerous. Manjobo or Manjova, the ruling chief, has several kraals on the west and one on the east side of the river, which here runs through a low flat plain of indurated alluvium 'as hard as marble.' The river banks are about two yards high, the stream being about fifteen feet deep and two hundred yards wide. Five sea-cows and eight crocodiles were seen at the crossing. Manjobo's kraal on the east side is called Emkontweni, the place where the spear is stuck in the ground. The chief is next in authority to Umganu, the son and successor of the celebrated Umzila, is very old, bald, and good natured, and commands the army of Umganu. The hostilities between his people and the Chobbas, or Machappas, have ceased on the latter agreeing to pay tribute. Previously they had been subject to raids which were little more than massacres, only the children being saved alive to be sold as slaves

to the Portuguese at Delagoa Bay, or kept in slavery by the victorious Amagwazas. The kraal is on the Limpopo, about twelve miles north of the Shangan River, which enters the former from the eastward, and is otherwise known as the Luize or Mitti River. From a hill just eastward of the Shangan the plain of Baleni could be seen extending northwest and southeast as far as the eye can reach, and about twenty-five miles in width. In the rainy season the plain is an immense pool or lake, and all the kraals are deserted for several months. Corn and millet reach a fabulous height; sweet potatoes, peanuts, melons, pumpkins, beans and bananas all seemed to flourish exceedingly. The Shangan is salt, but good water can be had by digging. The people call themselves Ama Shangani, and all the adults speak more or less Zulu, which is the language of the 'court.' Thence to Inhambane took nine days through a most populous country. Bingwana, a kraal of about 5,000 inhabitants, is about four days from Inhambane on the river of the same name, a deep but narrow stream, abounding in sea-cows. The route was considerably south of the one taken in 1884.

NOTES AND NEWS.

THE following extract from a letter of Mr. Louis Pasteur, to Professor Jules Marcou, dated Arbois (Jura), France, Sept. 7, is kindly furnished us by Professor Marcou. "I take a great deal of pleasure in the thought that, on my return to Paris, I shall present to the Academy of sciences an account of what I believe to be a very valuable prophylactic treatment against hydrophobia, applicable after the accident both to man and dogs. Do you not know some feature of this terrible disease which may be peculiar in America? Is it of frequent occurrence there? Remember that I should have the courage to apply my treatment even on persons who, after being bitten, had made the journey from Paris to America—although under these conditions at least two weeks must have elapsed since the accident—so great is my confidence in my method. However, I shall feel more sure of myself when I have made a large number of trials on man, which I shall do in 1885–86. I have as yet made but one trial—on an Alsatian boy, whose mother brought him to me. He had been bitten horribly on the fourth of last July, and death by hydrophobia seemed unavoidable. Up to the present time I have excellent news of his health, although it is sixty-four days since the accident."

— At the meeting of the American forestry congress, held in Boston, Sept. 22–24, the interest displayed by the public was extremely little; the attendance averaging from fifty to a hundred. The following papers were read: Facts in regard to the present state of American forestry, State of forest legislation in the United States, by N. H. Egleston; Forests of California, Prentice Mulford; The Middlesex Fells, Elizur Wright; Massachusetts forestry law, Dr. George B. Loring; Arbor day, B. C. Northrop; Forest economy in Canada, Walnut culture in southern latitudes, Hon. H. J. Joly; What have the different states done in regard to their forests? J. S. Hicks; The forest laws of Colorado, E. T. Ensign; What are the requisites of an effective forest fire legislation, S. W. Powell; Spark arresters for locomotives, J. N. Lander; Relation of forests to floods, T. P. Roberts; Lumbering interests—their dependence on systematic forestry, J. E. Hobbs; Charcoal interests and the maintenance of forests, John Birkinbine; Lumbermen's waste as a fertilizer, B. E. Fernaw; Trees as educators, Prof. Edw. North; Arbor day celebration in schools, J. B. Peaslee; Seacoast planting — its importance, practicability, methods; August planting of evergreens, W. C. Strong; Recuperation of barrens by tree planting, B. G. Northrop; The osier willow and red cedar, E. Hersey; On the distribution of economically important resiniferous pines in the southern United States, and on the production of naval stores, C. Mohr; Profits of forest culture, B. P. Poore; The new version of the children in the wood, Rev. A. D. Mayo; Needs of a national forest policy, Hon. Warner Miller; Profits of forest culture, State of forest legislation in the state of New York, Hon. H. R. Low.

— The American astronomical society of Brooklyn, N. Y., issued in August last the first number of its publications, bearing the title 'Papers read before the American astronomical society,'—a pamphlet of thirty-two octavo pages. It appears to be a selection from the papers read before the society during the year 1884, and the first half of 1885; and among the papers we find, 'The disappearance of the water and atmosphere of the moon,' by Prof. George W. Coakley; 'On the structure and age of the universe,' by Garrett P. Serviss; 'Relation of sun-spots to meteorology,' by G. D. Hiscox. It is a matter of congratulation that a society in this country devoted solely to astronomy is to be found in such a flourishing condition as to be able to print its proceedings so promptly.

—Dr. D. G. Brinton of Philadelphia, has now in press the sixth volume of his Library of aboriginal American literature. It is the annals of the Cakchiquels, written by a native about 1560, and never

printed. The Cakchiquels were a semi- tribe in Guatemala, and were reported by Spanish explorers to have annals reaching years before the conquest. The work printed from the unique original MS. in alphabet of that tongue.

last volume (175) of the Philosophical of the Royal society of London, con- short report on the total solar eclipse of 1882, prepared by Captain W. de W. and Dr. Arthur Schuster. The English which Captain Abney and Dr. Schuster embers, observed the eclipse at Sohag, the bank of the Nile, in Upper Egypt. It remembered that during totality there was by several of the observers a luminous the sun, which, by the photographs, beyond a doubt to be a comet; and it as a very conspicuous object in a well- engraving accompanying the present The following description of the comet's is given: "The nucleus is exceedingly sharply defined, the tail is somewhat did not point toward the sun's centre, direction nearly tangential to the limb. of the tail was roughly two-thirds of a ter. . . . The different eclipse par- at Sohag, decided at a joint meeting, clipse, to give the name of *Tewfik* to the cognition of the Khedive's generous This curious discovery, during a total a comet which eluded all subsequent suggested to Dr. Holetschek, to enquire ditions which must be fulfilled by an the comet should be hidden in the sun's the whole time, that its absolute bright- supposed to render it otherwise visible. dation is not, of course, susceptible of exactness, but the results are, however, show that the 'clandestine' passage of as the eclipse of the sun surprised probably not of so rare occurrence as first be inclined to suppose.

tistics demonstrate that England has of colony to the square mile of her Holland, 54; Portugal, 20; Denmark, 1.90; and Spain 0.86 square miles. British colonies is nearly 8,000,000 rather less than the area of the Rus- including Siberia and Central Asia; of the Native Feudatory States in ing to 509,284 square miles, be which England exercises as great con- ness over much of the territory together with that of the United Kingdom itself, 120,757 square miles, then the area of the British Empire exceeds that of the Russian Empire by about 200,000 square miles; and it covers within a fraction of one-sixth of the whole land area of the globa.

—A new Burmese embassy has been despatched to Europe. It consists of an ambassador, two secretaries, and two clerks. It is stated that some Burmese ladies accompany the party, and ten students, who are to be educated in Europe.

—The *Génie civil* publishes some interesting particulars with reference to the production and sale of petroleum in the Caucasus. There are about 400 wells in the vicinity of Baku, but only about half of them are at present being worked. The gross total of the petroleum extracted during the last three years is as follows:—800,000 tons in 1882, 1,000,000 tons in 1883, and 1,300,000 tons last year. Nearly the whole of this is converted into lamp oil at Baku itself, about a pound of good oil being obtained for three pounds of petroleum. There are 150 petroleum refineries at Tchorny Gorod (the black town), near Baku. In the course of last year, 200,000 tons of lamp oil, 190,000 tons of second-quality oil, and 500 tons of residuum were exported, these figures showing a slight increase over those for 1883 and 1882. The exports were distributed in about even proportions over the principal countries of western Europe.

—Herr Lüderitz of Bremen has always commissioned his agents on the west coast of Africa to make collections of the tools and utensils of the natives with whom they traded, believing that they would very shortly disappear before European civilization. The result of this policy is a very admirable collection of curiosities which Herr Lüderitz has now presented to the new Ethnographical museum at Berlin.

— In the *Comptes Rendus* for August 10, M. Crova describes a self-recording actinometer for giving a continuous record of solar radiation, and a plate shows the record of one day. It is principally valuable as showing the enormous and sudden fluctuations which are constantly going on in the atmospheric absorption of these radiations, thus confirming the results of Professor Langley's researches at Alleghany and on Mt. Whitney, and showing more graphically than anything else could do the tremendous difficulties with which he was obliged to contend, and the vast number of settings that must be made in these delicate quantitative measurements with the bolometer, in order to reach fairly average values of the ever-varying amount of energy that reaches us.

— At a recent meeting of the Deutsche gesellschaft für natur und völkerkunde Ostasiens, Dr. H. Fesca gave a paper on the agricultural circumstances of Japan in general, and of the province of Kai in particular. In the opinion of the author, wages in Japan are not less than in western Europe, especially in Germany. To this Dr. Wagener agreed, and added that apparent exceptions could always be traced back to purely local conditions. For instance, in many places porcelain was manufactured very cheaply, because the clay was prepared by the peasants quite incidentally ; on their way to the field they took a basketful of clay from a pit in the neighborhood, delivered the raw material to a pounder driven by water found on the way, and on their return carried for little pay the ready pounded clay to a manufacturer. In the same way, Mr. Netto said, in many places gold is washed, where a regular trade would by no means pay ; on rainy days, or when for any reason field work is interrupted, the people go to washing gold, since other work is not at hand.

— Concerning the little filaments of ice that appear on the surface of the soil after the first frost succeeding a heavy rain, W. Prinz (*Ciel et terre*, July, 1885) states that they are pressed out from the soil through small openings by the expansion of water in the ground as freezing proceeds. The size of the filaments depends upon the size of the openings through which they have been forced by expansion from behind, and the flutings with which they are covered correspond with irregularities in the walls of the openings through which they are forced.

— New Grenada possesses agricultural and mineral resources of the first order, which the opening of the routes across Panama will no doubt develop. The lower valley of the Magdelena, it is true, being formed of impermeable ground kept very moist by forests, is a seat of malaria and of yellow fever. The high valley of Honda is better favored, being much more permeable, less woody, and unvisited by miasma and fever. In revenge, however, the Indians and native blacks live in fear of leprosy, and all races are liable to the curious carathé, a disease which discolors the skin in places, more particularly the face, hands and feet. On the sides of the mountain, however, the climate is much more agreeable and very healthy. The population of New Grenada, a mixture of Spaniards, negroes and Indians, is about 2,000,000, and is spread over a territory much greater than that of France.

—At the Aberdeen meeting of the British association Lieutenant-colonel Playfair referred to the fact that the remains of magnificent Roman farms were to be found on the sandy plains of Tunis. The little hillsides were now nothing but sand, for the vegetable mould which once covered them has been washed away, and may now be found in the neighboring valleys buried beneath some feet of sand and water. No more striking instance of the importance of preserving forests could, in his opinion, be found.

WASHINGTON LETTER.

The society of science in Washington has its 'season' nearly as well defined as that of fashion, and almost coincident with the departure of the votaries of the latter is the setting out to various quarters of the globe of the representatives of the former. Not all, but a very considerable number of the scientific men of the capital are 'in the field' during the summer months, but they are there for work and not for pleasure, except such as is naturally incident to their more serious occupations. Just now they are beginning to reappear; the various scientific bureaus are taking on an appearance of initial activity, and the rooms of the Cosmos club, in which the various elements that go to make up human knowledge are wont to hold high carnival, are gradually losing that lonesome and deserted appearance which has been their chief characteristic for some months. It is to be presumed that these laborers have brought their harvest with them, and that during the coming winter they will be busily occupied in its threshing and winnowing, and in its dedication to the public good through the public printer.

In the meantime the home contingent has not been extremely small, nor has it been entirely idle. It is safe to say that in at least one case, that of the coast and geodetic survey, the affairs of the central office have, to an unusual degree, occupied the thoughts of those connected with it, and, indeed, of many others who are interested in the true welfare of government scientific work. Among such, general satisfaction was expressed with the action of the administration in the selection of Professor Agassiz as its superintendent, and great disappointment that he felt constrained to decline the responsibility. Under decidedly unfavorable conditions most of the regular work of the survey has gone on without serious interruption. One of the veteran observers of this corps, Mr. George W. Dean, was in the city a day or two recently, having returned from a longitude campaign at Colorado Springs and various connecting points.

In the geological survey, while the geologists, topographers, etc., have spent the summer in the field, the chemical laboratory under Professor

Clarke has been almost constantly in active operation. Mr. Hallock has spent some time at the Watertown arsenal, utilizing its great testing machine in certain important pressure experiments. This work will be continued, and will include a repetition of some experiments already made by others under less favorable conditions as well as a number of new researches. The survey has recently published Bulletin No. 14, on 'the physical characteristics of the iron-carburets, etc.,' the joint work of Carl Barus and Vincent Strouhal. This treats especially of the electrical and magnetic properties of steel and cast iron, and is a really valuable contribution to our knowledge of these important metals. Much of the work was done while Mr. Barus was in Europe working in conjunction with Strouhal; some of it has been previously published in certain European journals. Many additions have been made, however, by Mr. Barus since his connection with the survey, and the whole now appears for the first time in English, in a volume of more than two hundred pages.

Professor Riley of the Department of agriculture is now revising the final proof sheets of the 'Fourth report of the U. S. entomological commission.' This report is on the cotton worm, being the final report on the same, together with a chapter on the boll worm. It will contain sixty-four plates and about five hundred pages of text. Three thousand copies have been ordered printed by congress. The preparation of this report was virtually completed in 1882. A part of the delay in its publication is due to a desire on the part of the entomologist to complete some special researches, and especially to obtain a more exact knowledge of the facts in reference to Aletia in Brazil, as bearing on the hibernation and introduction of the species within the States. To this end Dr. John C. Branner was sent to Brazil, remaining there about four months and returning with a large amount of interesting material, which has been utilized in the report. Again, the work of the preparation of this volume has necessarily been made secondary to that of the entomologist in a general way, including the issue of special bulletins and annual reports. But no small portion of the delay is to be attributed to the difficulties incident to the publication of such scientific reports by the government. During the winter season when the authors of scientific papers can naturally give more attention to their publication, the public printer finds it necessary to devote the energies of his establishment to the printing of miscellaneous congressional and other public documents. In the summer the naturalist is in the field, occupied with the prosecution of research, and has little leisure for literary or editorial labors. Yet it is a fact that the report was formally submitted in March, 1884, the bulk of it was in type and the illustrations prepared by the fall of that year. It is to be hoped that no further delays will prevent its being placed in the hands of the public at an early date.

The entomological commission, consisting of Professors Riley, Packard and Cyrus Thomas, has now prepared four large volumes, three of which have been published, one is about to be issued, and a fifth is in preparation. The whole embodies the results of the work of the commission, which has been in existence about five years.

The naval observatory has just issued its annual volume containing the 'Washington observations for 1881.' Besides the usual astronomical and meteorological observations, it contains two appendices by Professor Hall, one on the satellites of Uranus, and the other on the satellite of Neptune. It is pleasant to reflect that these publications are of permanent and lasting value. Their tardy appearance would otherwise seriously interfere with their usefulness. No systematic study of the new star in Andromeda has been made at the observatory. It has been examined from time to time by several of the astronomers, and a few measurements of position have been taken. The navy department is engaged in the construction of a magnetic observatory in the grounds of the naval observatory. It is understood to be under the charge of the bureau of compasses.

A seismological conference was held in the office of the director of the geological survey about a year ago, in which were representatives from the survey, the signal service, the naval observatory, and a few persons not in government employ, who have long been interested in seismology. The proceedings were noticed at length in this journal at the time. The explosion of a vast amount of dynamite at Flood Rock offered an opportunity for the study of what might be called an artificial earthquake, and it was determined to take advantage of it and make such observations as were found to be possible. The uncertainty as to the exact time of the explosion, and the difficulty of obtaining information concerning it, prevented such complete prepation as would have been desirable and possible under other circumstances. Circulars were sent, however, to directors of astronomical observatories in the neighborhood of New York City, requesting co-operation, and by direction of the director of the geological survey, the chief signal officer and the secretary of the navy, Professors Clarke, Mendenhall, and Paul, will go to New Y
ize in the best possible manner the
pliances at hand. Several seism
completed, and a seismograph w

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The Year of the Sun

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SCIENCE.

FRIDAY, OCTOBER 16, 1885.

COMMENT AND CRITICISM.

THE INTEREST EXCITED in England by the address of Sir Lyon Playfair before the British association is well shown in the comments of the London press, which are summarized in an article in *Nature* for September 24. The subject of state aid to science has been before the English public for many years, but has never attracted at any time the same earnest and general attention that it has since Sir Lyon Playfair's address. The comments of the London *Times* upon the address probably best show the condition of public opinion upon the question in England. The *Times* acknowledges the reproach that countries less wealthy than England make efforts to encourage science, by the side of which the encouragement afforded in England by the state sinks into insignificance; but it urges that, aside from state aid, there are the large ancient endowments for the benefit of education, which, although they may still be largely misapplied, yet could be used for the encouragement of science if vested interest and lack of intelligent initiative did not stand in the way. The *Times* urges that, until these obstacles are removed by the pressure of an active intelligent public opinion in England, the state itself can hardly be expected to do more than it does.

THERE HAS LATELY GONE THE ROUNDS of the press a description of a meteorite which startled south-western Pennsylvania on September 26. It was reported that it finally struck the earth on the farm of Mr. Buckston, Jefferson township, Washington co., near the West Virginia line. The stone was said to have been broken into three pieces, which became partly buried in the ground. The color was described as gray with streaks of red running over it, and the size of the meteorite was given as from 30 to 50 feet in diameter. The last statement was not, however, received by all as probable. We wish to call attention to a letter in another column, from Prof. S. P. Langley of the Allegheny observatory, who sent one of his assistants to examine into the truth of the reports. It seems that the 'red streaked' meteorite, 50 feet in diameter, is a fiction of the news-gatherers.

TIMING THE FLOOD ROCK EXPLOSION.

HOWEVER successful the explosion at Flood Rock may have been as to its main feature in the removal of an obstruction to navigation, it is to be regretted that one of the minor features of considerable scientific interest should have been seriously interfered with by the blundering delay in the time of firing the mine. At the request of the U.S. geological survey, observers at a dozen or more observatories within 200 miles of New York were watching to note the time of arrival through the ground of the tremors from the explosion, observing in most cases with their meridian-instruments over the mercury nadir-basin, much the most powerful and sensitive apparatus for detecting tremors.

Reports at hand up to time of writing indicate that out of 17 stations (3 occupied by geological survey parties and 14 co-operating with them) 5 hung on till the disturbance came and got more or less satisfactory observations (at one of these the rock was directly in sight, and the others so near that the observers felt sure that it had not escaped them); 4 observed and timed some slight disturbances between $11^h\ 3^m$ and $11^h\ 7^m$, and, attributing them to the explosion, ceased watching for more, and either missed it entirely or were taken by surprise with chronographs stopped, etc.; 2 heard nothing at all up to about $11^h\ 10^m$, and so ceased observing, and missed it; and 6 are yet to be heard from. The observations of those who got any records at all must be considered as due to persistent pluck and good luck rather than the natural and easy result of intelligent co-operation on the part of the army-engineers.

H. M. PAUL.

SCIENCE AND THE STATE.

SIR LYON PLAYFAIR, in his recent address before the British association in Aberdeen, said much that was instructive and suggestive in respect to the progress of science, and the conditions on which it depends; but there is one portion of his address which is entitled to careful perusal, because the speaker is one of the few men in the world who has had the training of a man of science and of a statesman. His early career, as the older readers of *Science* must be aware, was that of a chemist; and of late he has been an active

and *influential* member of [illegible] time he held a seat in the [illegible] positions, as a savant and [illegible] entitled to speak upon the [illegible] to science. It is interesting [illegible] ciples which he defends were [illegible] Albert in his address at Aber[illegible] before by George Washington [illegible] dress. Prince Albert said: "[illegible] Science should "speak to the [illegible] child to its parent, sure [illegible] for its welfare," and also "[illegible] recognize in Science [illegible] strength and prosperity, [illegible] est dictates of self-interest" [illegible] of Washington hardly needs [illegible] own readers: "Promote as an [illegible] importance institutions for the general diffusion [illegible] knowledge. In proportion as the structure [illegible] government gives force to [illegible] essential that public [illegible] enco[illegible]"

Sir Lyon Playfair [illegible] the Arabs, to remain [illegible] wel[illegible] as modern times the [illegible] has been a duty [illegible] intermediate silhouette [illegible] affairs in the United States [illegible] working classes [illegible] selecting as their candidates [illegible] men, election shall [illegible] Massachusetts and Rhode [illegible] systems, provisions [illegible] enacted [illegible] laws.

In confirmation [illegible] Playfair points [illegible] terminate also all [illegible] war between the United States [illegible] [illegible] offense [illegible] make the wisest [illegible] Playfair [illegible] use the [illegible] Science, [illegible] evidence [illegible] nature and [illegible] the most [illegible] the high [illegible]

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S. geological survey, together with repre-
ves from the naval observatory and the
service. Although the results of this work
be definitely ascertained for at least some
, the readers of *Science* will doubtless be
ted in a brief account of the methods of
it.

btless the most certain method of detecting
earth-tremors is by means of a vessel of
ry, from the surface of which is reflected
rom a series of pin-holes in an opaque sheet
tal or card-board, the image of the holes
observed and studied by means of a tel-
properly secured against accidental dis-
ces. The slightest ripple in the mercury
es a blurring of the image of the small pin-

Of course in an astronomical observatory
flected image of a star or of illuminated
neter lines will be equivalent to the above
ement, and in some respects superior to it.
reasing the magnifying power, the sensitive-
f this method of observation may be in-
d almost indefinitely, easily being carried
d what is desirable. A serious objection to
wever, is that the disturbance makes no
of itself, requiring, therefore, constant
ion from the observer during the entire
covering the possible arrival of the wave to
ected. The great convenience of the method
e ease with which it can be used at most
omical observatories, taken in connection
ts great sensitiveness, justified the sending of
rs inviting co-operation to directors of ob-
ories within the possible radius of appre-
disturbance. These were issued a week
the explosion, and, on the night previous to its
ence, telegrams were sent to those who had
ted a disposition to co-operate, informing
f the exact hour fixed for the event.

party proceeding from Washington, con-
of Professor F. W. Clarke, Professor H. M.
nd the writer, in addition to being provided
he necessary apparatus for mercury ob-
ons, carried three seismoscopes and one
graph, together with a number of chronom-

seismoscopes were of a form recently de-
in the physical laboratory of the U. S.
service, and were constructed by Mr.
, the mechanician of the geological sur-
They were hastily prepared for this expedi-
nd have not yet quite reached their final
but a brief description of one may be of
t.

eel wire about two millimetres in diameter
so as to form a loop at the end about eight
length and twelve mm. in breadth, the sides parallel and the ends round; from one end a long needle of the same wire projects, its length being three or four times that of the loop, and its point very sharp. A cylindrical iron weight, of one or two kilos, has a hole drilled through it along the axis, large enough to freely pass the looped end of the needle, one part of this hole being of somewhat smaller diameter than the other. A small circular steel plate, with opposite sides cut away, fits the larger bore and rests on the shoulder of the smaller. Through the centre of this plate a steel screw passes downwards, the point of which rests in a small cup made in the centre of the round end of the loop, from which the needle projects. The upper end of the loop reaches a short distance through the cylindrical weight, and hangs upon a small hook rigidly secured to the cast-iron support. When in position, the steel points, on which the weight is supported, are sufficiently above the centre of gravity to insure stability. It is easily seen that this point is approximately that about which instantaneons rotation of the needle takes place when the system is slightly disturbed, and that any motion of the sustaining hook is greatly magnified at the point of the needle. Just below the latter is a sort of lever-trigger, moving freely about a horizontal axis, from the short end of which projects in a vertical direction a very fine wire two or three mm. in length. To the long arm of the lever is fastened a platinum wire shaped like an inverted U, with the legs resting in mercury cups. The instrument is 'set' by lifting the long arm until the fine wire at the end of the short arm rests on the point of the projecting needle, in which position it remains with the platinum wire out of the cups and the circuit broken. A slight jar produces motion in the needle, releasing the short wire and allowing the long arm of the lever to drop and close the circuit. The instrument may be made as sensitive as is desired by diminishing the size of the needle point and of the small wire which rests upon it. The advantage of an instrument of this kind is obviously its automatic operation. It can be joined up with a chronograph and left to register its drop without further attention.

One of these seismoscopes was thus connected with a chronograph in the basement of one of the buildings belonging to the Emigrant's hospital on Ward's Island. No better point could have been found, as it was in full view of and almost the nearest point on land to Flood Rock. The writer must express his indebtedness to Dr. Marple, the physician in charge, and to others connected with the hospital, for the generous manner in which all facilities at hand were placed at his disposal in the arrangement of this station. A mercury observa-

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it synonymous with deodorization. From our point of view the destruction of sulphuretted hydrogen, or of ammonia, in a privy vault is no more disinfection than is the chemical decomposition of these gases in a laboratory experiment. But when we destroy the infecting power of vaccine virus, or of the blood of an animal dead of anthrax, we disinfect this material no matter where it may be. "There can be no partial disinfection of such material; either its infecting power is destroyed or it is not. In the latter case there is failure to disinfect. Nor can there be disinfection in the absence of infectious material" (Preliminary report of committee on disinfectants of the American public health association).

Using the term then, in this restricted and scientific sense, what tests have we of disinfection, and what are the best disinfectants? The evidence of disinfection must evidently be based upon experiments which show that the infectious material has lost its specific infecting power. Such evidence we obtain from three sources: (*a*) practical experience in the use of disinfectants; (*b*) inoculation experiments upon susceptible animals; (*c*) biological experiments upon pathogenic micro-organisms—the test being failure to multiply in a suitable culture-medium after exposure to the disinfecting agent in a given proportion for a given time.

Until guided by exact data obtained in the laboratory the progress of our knowledge relating to disinfection was slow and uncertain. While agents now recognized as efficient were frequently resorted to in the pre-scientific period, they were often used by the sanitary authorities of the day in amounts entirely inadequate for the accomplishment of the object in view; and for the vulgar a disinfectant was a charm which was supposed to exorcise the disease-producing agent in some mysterious way. We must accord a certain value to the experiments of sanitarians in their efforts to restrict the extension of infectious diseases, although the evidence of successful disinfection offered by 'practical' men will not always stand scientific criticism. When a house in which a case of small-pox has occurred is fumigated with sulphurous acid gas, and this fumigation is followed by a thorough cleaning up, a liberal application of whitewash, and vaccination of everyone in the vicinity, it must always remain a matter of doubt whether the small-pox infection was, or was not, destroyed by the fumigation. In experiments made in practice—either clinical or sanitary—we have rarely any comparative test, and an undue value is often accorded to negative evidence. Laboratory experiments are, therefore, essential as a check upon 'experience,' and as a guide for successful practice.

Many experiments have been made directly upon infectious material, without reference to the exact nature of the infectious agent present in this material—the test of disinfection being failure to infect susceptible animals after treatment with the disinfecting agent. Of this nature were the experiments of Davaine upon the blood of animals dead with anthrax, or with infectious septicaemia; of Baxter and of Vallin upon the virus of glanders; of the writer upon septicaemic blood; and of numerous observers upon vaccine virus. The experiments upon dried vaccine—upon ivory points—are among the most satisfactory of these; for the inference seems to be quite safe, that whatever will destroy the specific infecting power of this material will also destroy the small-pox virus. The writer's experiments (1880) show very conclusively that chlorine and sulphurous acid gas are agents which may be relied upon for the destruction of the infecting power of this material—due regard being paid to the necessary conditions relating to quantity and time of exposure.

Since it has been demonstrated that the infecting power of certain kinds of infectious material is due to the presence of micro-organisms, numerous experiments have been made to determine the exact germicide power of a variety of chemical agents, as tested by these demonstrated disease-germs, and by non-pathogenic organisms belonging to the same class. These experiments show that, while the resisting power of organisms of this class differs within certain limits, in the absence of spores, a germicide for one of these organisms is a germicide for all. There is a wide difference, however, between the resisting power of spores, and that of bacteria in active growth. The growing plant—micrococcus, bacillus, or spirillum—is quickly destroyed by a temperature of from 150° to 160° F., while the spore resists a boiling temperature for several hours. Carbolic acid (2% sol.), sulphate of copper (1% sol.), and various other agents which are efficient for the destruction of active bacteria, fail in concentrated solution to kill spores. The experimental evidence on record indicates that the following named disinfectants are the most generally useful, from a practical point of view:—

Moist heat. A boiling temperature quickly destroys all known pathogenic organisms in the absence of spores. A temperature of 230° Fahr.—steam under pressure—maintained for ten minutes, will destroy spores.

Chloride of lime. A four per cent solution quickly destroys all micro-organisms, including spores. Labarraque's solution (liquor sodae chlorinatae) is equally efficient when of corresponding strength.

advised the boy to abandon the thought of a commercial life, toward which he had been pointed, and in place thereof, to prepare for the medical profession. Two years were next spent in Zurich; and at the age of nineteen Agassiz was enrolled at Heidelberg. Several letters pertaining to this period are given. Here it was that by the introduction of Tiedemann, he became acquainted with one of the most valued friends of his whole life, Alexander Braun, afterward director of the botanical gardens in Berlin. "Braun learned zoölogy from Agassiz, and he in his turn learned botany from Braun;" and so it came to pass that through life "Braun knew more of zoölogy than most botanists, and Agassiz combined an extensive knowledge of botany with that of the animal kingdom." Karl Schimper was another friend of this period. Leuckart and Bischoff were his favorite teachers, but Tiedemann, Braun, and Nägeli were also valued instructors. We do not recall in biographical literature a more interesting account of the development of a naturalist's youth than is given in this opening chapter. Every teacher of boys ought to read it, for it illustrates the importance of discovering the bent of a young mind, and of affording it the requisite opportunities.

A far more stimulating life than that at Heidelberg awaited Agassiz, Braun, and Schimper in Munich, where Dollinger, Martius, Schelling, and Oken, were among their eminent teachers. For this period Mrs. Agassiz has brought together the letters interchanged between the student and his circle at home. Nothing could be better than the glimpses which they afford of the university influences surrounding a youth of twenty-one, in vacation and in term-time. 'The little academy' which was constituted by Agassiz and his comrades, has become historical. But more interesting than anything else in this part of the memoir is the draft of a letter from Agassiz to Cuvier, which has been preserved, although nobody can now tell whether it was actually sent to the eminent man in Paris, whom Agassiz wished to consult with reference to his future career. He tells what he has done and what he wishes to do, and he brings his confession to a close in these words:—"I seem to myself made to be a travelling naturalist. I only need to regulate the impetuosity which carries me away. I beg you then to be my guide." If Cuvier did not receive this letter, he did receive the work on Brazilian fishes dedicated to him by Martius and Agassiz, and his acknowledgment is preserved and printed. The story of Agassiz's youth is brought to a close by an autobiographical sketch which he once dictated, and "which forms a sort of summary of his intellectual life up to this date."

The next chapter tells of his actual acquaintance with Cuvier and his prosecution of the study of natural history in Paris under great pecuniary limitations and anxieties. Here we read the romance of education. One day Cuvier asked Agassiz to do something, saying, "you are young; you have time enough for it; and I have none to spare." This task proved a legacy. They worked together till eleven o'clock, when they paused for breakfast; and then resumed their occupations until dinner-time, when Agassiz excused himself. Cuvier told him that he was quite right not to neglect his regular hours for meals, and commended his devotion to study, but he added, 'Be careful and remember that *work kills*.' "They were the last words Agassiz heard from his beloved teacher. The next day, as Cuvier was going up to the tribune in the Chamber of deputies, he fell, was taken up paralyzed and carried home. Agassiz never saw him again."

With Humboldt, as well as with Cuvier, Agassiz became acquainted in Paris, and was greatly encouraged by his friendliness. Offers were made to Agassiz to remain in Paris, but Humboldt advised him to accept a professorship in Neufchâtel. This he did in 1832, when he was twenty-five years old, and then his independent life began. Teaching became "a passion with him, and his power over his pupils might be measured by his own enthusiasm." "From the beginning his success as an instructor was undoubted." "The little town suddenly became a centre of scientific activity," and the young professor's name was so favorably known that he was soon called to a chair in Heidelberg, which he could not make up his mind to accept. In 1833, he married Cecile, the sister of Alexander Braun.

During the ten years following (1833–1843) Agassiz was engaged upon the great work of his early life, the 'Researches on fossil fishes.' Offers of coöperation came to him from noted investigators, and he was known in all the museums of Europe as an indefatigable worker and collector. The first American subscriptions to his great work were received through Benjamin Silliman; in Germany, Humboldt continued to be his adviser and friend; the Wollaston medal was awarded him in London. In 1836, 'a new and brilliant chapter of his life was opened,'—the researches upon glacial action,—and he presently startled the Helvetic association "by the presentation of a glacial theory in which the local erratic phenomena of the Swiss valleys assumed a cosmic significance."

Agassiz was now driving all his steeds abreast; besides his professorial duties he was printing his 'Fossil fishes,' his 'Fresh water fishes,' and his

investigations on fossil echinoderms and mollusks, —all requiring the most careful illustrations. His researches upon glaciers also occupied a great deal of his thought and time between 1836 and 1846. Desor coöperated with him, and so did Arnold Guyot, the acquaintance of his boyhood, the colleague of his middle life, and the friend of his advancing years. In the winter of 1840 the 'Études sur les glaciers' were prepared for publication. The memoir introduces the fascinating story of the 'Hôtel des Neuchâtelois,' and the observations of Agassiz, Guyot, Desor, Vogt, Pourtâles, Nicolet, Coulon and others, and it closes with an account of the ascent of the Jungfrau, by Agassiz, with his five friends and six guides.

About the year 1842, the thoughts of Agassiz turned toward the United States as a region to be studied. Charles Bonaparte, Prince of Canino, was expecting to make the journey and desired to secure his company; but the plan fell through, and in the following spring Agassiz raised this significant question; "Do you think any position would be open to me in the United States where I might earn enough to enable me to continue the publication of my unhappy books, which never pay their way because they do not meet the wants of the world?" Two years later the king of Prussia granted him 15,000 francs for his journey. He sailed for America in September, 1846. Little did he or his friends suppose that he was to make a permanent home in America. "So closed this period of Agassiz's life. The next was to open in new scenes and under wholly different conditions," to which the second volume introduces us.

We have purposely devoted the most of our space to the European portion of this memoir, because the later years of Agassiz's life are so familiar to American readers. We now turn to the second volume, which exhibits the same editorial tact, the same skilful selection and presentation of materials, as the first, and doubtless to many readers it will be more entertaining.

Agassiz first came before the public in this country when he delivered a course of lectures at the Lowell institute. The memoir gives a long letter which he addressed to his mother in December, conveying his impressions of American science and American scientific men, and particularly his observations on a journey from Boston to Washington. Silliman, Dana, Shepard, Gray, Redfield, Torrey, Morton, Lea, Haldeman, Bache, Bailey, Baird, LeConte, are among the familiar names of those whom he met in travel. Another familiar letter to Milne-Edwards gives his impressions of other men and other phases of scientific activity. To Elie de Beaumont he writes of the glacial drift in New England, a problem which always arrested the attention of his practised eye. To oceanic studies he was introduced by the opportunities afforded him on the steamer Bibb, of the U. S. coast survey, through the enlightened invitation of Dr. Bache and Captain Davis. "Here," says the biographer, "was another determining motive for his stay in this country. Under no other government, perhaps, could he have had opportunities so invaluable to a naturalist."

The political revolution of 1848, which released Neufchâtel from the sovereignty of Prussia, released Agassiz from the service of the King of Prussia, and made him free to accept the overtures of a professorship in the Lawrence scientific school of Harvard college, then about to be established, where he was guaranteed a salary of fifteen hundred dollars, until the fees of the students should be worth twice that, a period 'which never came.' The memoir gives a delightful picture of the society of Cambridge in those days, and of the household arrangements, over which an old Swiss friend, 'Papa Christinat,' presided. Then began 'in an old wooden shanty set on piles,' which might have served as a bathing or boat house, that museum which has grown by the united labors and the devotion of father and son, to be the great Museum of comparative zoölogy in Cambridge. His second marriage took place in 1850, and from that time on Agassiz was identified with the United States. No offers, however tempting, could induce him to give up the delightful circle to which he was bound in Cambridge and Boston.

His scientific journeys to Florida, to Lake Superior, to Brazil, and finally around Cape Horn to California, are so well known to naturalists that we only allude to them. His participation in scientific assemblies; his interest in science-teaching in common schools; his power in developing the school of naturalists now leading in so many branches of science throughout this country; his attractiveness as a public lecturer; his magnetism as a collector; his wonderful beginning of the 'Contributions to natural history;' his beautiful friendship; his devotion to his adopted land; his desire to contribute in every way to the good of the public;—all these characteristics are so fresh in the recollection of Americans that they will turn with great delight to the pages in which the details are beautifully brought out.

These volumes deserve to be read by all who are interested in the development of a noble and completed life, which was marked, as the biographer says, by rare coherence and unity of aim.

ASTRONOMICAL NOTES.

An important series of observations upon terrestrial refraction is reviewed in the *Bulletin astronomique* for August. They were made at Pulkowa upon three signals in the plain below, whose distances were about 12, 5, and 2 km., with zenith-distances of about 90° 17', 90° 36', and 91° 5'. They are very completely discussed as regards temperature, steadiness of images, clear and cloudy sky, hour-angle of sun, etc.; but the most remarkable feature is the persistent negative refraction for the nearest station, under all circumstances, the same for the middle station at temperatures much above the freezing point, and the wide departure of all the observed refractions from those given by standard formulæ. The certain indication of a maximum density of the air at some distance above the ground (due probably to rapid fall of temperature in rising from the latter) deserves further investigation at the hands of geodesists, and astronomers as well, for the latter cannot be assured that their observations, especially at considerable zenith-distances, may not be affected by such abnormal density of strata immediately overhead.

The observation of the spectrum of the new star in the nebula in Andromeda—a matter of the greatest importance—seems to present considerable difficulties. By many observers the spectrum has been pronounced continuous. Dr. Huggins, however, observing on September 9, feels confident of from three to five bright lines between D and *b*. Dr. Vogel notes that the intensity of the colors is somewhat different from ordinary star spectra, and he suspects a dark band on the border of the yellow and green, and a second in the blue between F and G. Dr. von Konkoly of the O'Gyalla observatory, considers the spectrum as belonging to Type III. *b*. He found in the red, yellow, green and blue what seemed to be bright bands on a dark ground. If this suspicion is confirmed, these broad, bright bands would correspond to the hydrogen lines C and F, and to the line D_3, and they would also indicate a very great pressure.

A telegram from the Harvard college observatory announces the discovery by Palisa of a 13th mag. asteroid, which may perhaps be Eudora, which has not been observed since its discovery-opposition in 1880. If it turns out to be a new one its number will be 251. It seems that Palisa discovered 250 while hunting for Rhodope 166, which has only been observed at two oppositions, though the present is the sixth since its discovery. If the Vienna 27-inch refractor is to be given up to asteroid discovery, it is to be hoped that it will be the search for old missing numbers rather than new and faint bodies, which, though easy objects in a 27-inch, would be beyond the reach of any but a few of the largest instruments, and they are generally devoted to more important work.

The late discussion as to the identity of Biela's and Denning's comets (*Observatory*, 1885, pp. 257 and 306), in which it is supposed that violent perturbation by the earth threw Biela into the orbit of Denning at the time of the great meteor-shower of 1872, November 27, would seem to be disposed of in the *American journal of science* (xxx., 322), where it is shown that, in such case, the radiant-point of Biela must have been swung round about 125° or 130°, which would call for an approach to the earth's centre nearer than 4,000 miles. On the hypothesis of identity, then, the comet must have gone *through the earth* somewhere.

NOTES AND NEWS.

The third international geological congress held in Berlin at the close of last month had an attendance of 239 members, of which three-fifths came from Germany. The next largest number (18) came from Italy, and the United States came, with Belgium, sixth on the list—Canada was not represented. Among those present from the United States were Professors James Hall, Newberry, Brush, H. S. Williams and Dr. Persifer Frazer.

— The superintendent of the geological survey of India gives an account of two meteorites, which are the first that have been examined under the recent order of government for the collection and examination of these objects. One fell on Feb. 9, 1884, at Pirthallee, in the Punjab; the stone was received in three pieces, weighing in all 1160.5 grammes, the specific gravity being 3.40; the shape was roughly cuboidal with rounded edges and indented sides. The other stone fell at Chandpoor last April, it weighed 1201.3 grammes, its specific gravity being 3.25, its shape being roughly cuboidal with rounded edges.

— We learn from the London *Engineering* that a short time ago a citizen of Boston, while on a visit to England, examined the map which accompanied the charter of the original Massachusetts Bay company, which formed the patent under which English settlements were originally made, and was surprised to see that the eastern boundary was defined by a line drawn from Hull at the southern extremity of Boston harbor to Nahant, a peninsula on the north. Now a rocky island of small dimensions, known as Middle Brewster, lies to the east of this line, and as the colony of Massachusetts never claimed it or

exercised any authority over it, the island was not included in the revolution of 1776. Has the jurisdiction of Great Britain lapsed in course of years? and if it has not, what are the dozen acres of rock worth? At present it is occupied by a few fishermen, and also contains the summer residence of a Boston attorney, who evidently knows the value of peace and quietness as well as that of nine points of the law.

LONDON LETTER.

THE health of the president of the Royal society, Professor Huxley, is a matter of grave anxiety to his numerous personal and scientific friends. The prolonged absence from work in the winter and early spring of this year failed to restore him to anything like his usual vigor, and last summer he judged it prudent to resign altogether most of his public appointments, especially those in connection with the teaching at the science schools, South Kensington. Whether he will retain the presidency of the Royal society is as yet undecided. As the official representative of the society, and indeed of science generally on all public occasions, the social claims upon him at these public appearances are very considerable. The amount of personal attention that has to be given by the president to work which makes no show is also very large, and more than one past president has had to resign the office on this account. At this crisis, therefore, a grave responsibility is cast upon the council and officers. It has been suggested that Professor Huxley should return with Professor Marsh, of New Haven (who is now on his way to Berlin, having attended the British association meeting), and should remain with him for a year, quietly working through his wonderful collection of dinosaurians. The interest of this to Professor Huxley could not fail to be great, as his forecast about twenty years ago of the probable course of geological discovery with regard to this great group has always been regarded as one of the most sagacious divinations of modern times.

Next to the president of the Royal society, the president of the British association for the advancement of science occupies the representative position above referred to. In this case, however, the *personnel* is changed every year. The appointment of Sir William Dawson, principal of McGill college, Montreal, to this distinguished position for the year 1886–87 (September to September) is a graceful recognition of the part which he took in promoting the most successful visit of the association to that city last year. He will succeed Sir Lyon Playfair, whose life-long labors on behalf of the higher scientific education found a natural expression in his recent presidential address at the Aberdeen meeting. One of the most remarkable features of this was the evidence it gave of the extent and variety of its author's reading, no less than sixty references being made in it to various books. Advocating as he did a greatly-increased expenditure on education in pure science, his address has been sharply criticised by those organs of the so-called 'practical men,' to whom everything that savors of the 'endowment of research' is as a red rag to a bull.

Next month will be a time of great political excitement in the United Kingdom, in consequence of the first elections of members of parliament by the new constituencies, created by the recent Reform act, the total number of votes having been increased by two millions. Signs are not wanting that science will be much more largely represented in the new parliament than it ever has been before. Sir J. Lubbock and Sir Lyon Playfair have hitherto been the two chief men to whom the house has looked for counsel and advice in scientific matters. It is expected that the distinguished chemist, Sir Henry Roscoe, will be returned for one division of Manchester, and that Professor A. W. Rucker, late professor of physics in the Yorkshire college, will be returned for one division of Leeds. Several other men of more or less scientific reputation are mentioned as possible candidates in connection with various constituencies.

The condition in which the river Lea has been during the last few months is one which illustrates the need of more scientific knowledge on the part of the legislature. This is a comparatively small river in the north-east of London, from the upper part of which one of the eight water companies which supply the metropolis with water is permitted by acts of parliament to pump daily large volumes of water. By other acts of parliament the suburbs of London (Tottenham, etc.), which in course of time grew up upon its banks, were permitted to pour their sewage into it at a point considerably below the intake of the water company. Of late years the enormous growth of London has practically rendered these suburbs a part of the metropolis itself. The neighborhood is a comparatively poor one, and the river and its banks used to be one of the most important recreation grounds in that district, boating, angling, etc., being freely indulged in. In consequence, however, of the diminution of the flow of water below the company's intake and the increase in the sewage, both of which are authorized by act of parliament, the condition of this part of the river during the past summer can only be likened, with justice,

to that of an open sewer. Several large indignation meetings have been held, as well as demonstrations of unemployed boatmen, etc.; and deputations have waited upon the Home secretary, but all to no purpose; this high official practically declared himself powerless to act, in consequence of the sanction of the law having been extended to both proceedings. On one Sunday during the warm weather, when the condition of the river became practically unbearable, the water company, yielding to strong representations made to them by medical men and others, raised its sluices and allowed the whole volume of the river to flow along its natural course. This produced a partial and temporary mitigation of the evils complained of at a considerable loss to the shareholders. Fortunately the summer heat has passed without serious outbreaks of illness in the neighborhood, but meantime the deadlock continues, and apparently will continue, until the new parliament reverses one or other of the decisions of its predecessors.

The condition of the Thames itself is an illustration on a large scale of the results of the same legislative action, and has been the subject of investigation recently by a royal commission. The Metropolitan board of works is the body charged with dealing with the sewage of London as a whole. At present the sewage of London is discharged into the Thames mainly at two points some miles below London bridge, one on the north and one on the south bank of the river. The latter station, called Crossness, which receives all the sewage from the Surrey side of London, was visited by the present writer, in company with several other members of the Society of chemical industry, last July; the object of the visit was to see the measures which had been taken by the board for the purpose of diminishing the nuisance caused by the sewage discharge at this point. For a considerable period on either side of low-water the sewage can be pumped direct into the river, but at other times it has to be pumped into huge covered reservoirs, which are allowed to empty themselves at low tide. The ameliorating measures consisted in running into the sewage during its discharge a solution of sodium manganate, mixed with a quantity of sulphuric acid supposed to be sufficient to decompose the sodium salt, liberating a solution of manganic acid. The sodium manganate was manufactured on the premises by fusing caustic soda (of which there was a large stock on the ground) with black oxide of manganese. The inefficiency of the process adopted, to do any real good, as well as its great cost, was somewhat freely commented on by the visitors, as well as the crude manner in which all operations were carried out. Several schemes are before the public for dealing with the sewage of the north bank of the river, some of which involve the use of Canvey Island, a large low-lying tract of land in the estuary of the Thames, where probably sewage irrigation could be carried out on a very large scale. We may perhaps recur to these in future letters.

The Society of chemical industry, before referred to, has just sustained a severe loss in the sudden death of one of its most active founders and past presidents, Mr. Walter Weldon, F.R.S. Wherever the manufacture of soda from common salt is known, Mr. Weldon's name was a household word. Not himself a manufacturer, his prolific brain devised a large number of most valuable improvements in various details of almost every branch of the alkali manufacture, including bleaching-powder, etc. He knew almost every alkali works in Europe, and his labors abroad received the recognition of the grand cross of the Legion of honor. His addresses to the society were most valuable *résumés* of the position and prospects of the alkali trade at the time at which they were delivered, and such as probably no other man could have written.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Flood Rock explosion observed at Princeton, N. J.

We had arranged to observe the arrival and character of the wave by reflection of images in mercury, and precaution was taken to stop all movement of pedestrians and vehicles within 500 or 600 feet of the observatory. At eleven o'clock (standard time), Professors Rockwood, McNeill and myself, were at our posts. Between 11.05.25 and 11.07.40 we, all three, observed, accordantly, a series of four slight tremors which blurred the reflected images in a pronounced manner. We now suppose they were due to trains on the railroad three miles away, or to carriages on the main street, distant more than 1,000 feet; but at the time we had no doubt that they were due to the explosion; and so, at 11.10, I stopped the chronograph, and took off the sheets.

Having a spare half hour in the morning, I had rigged up a very rude, but fairly delicate, vertical seismoscope, which was connected with a cylinder of the chronograph so as to make an automatic record of anything vigorous enough to affect it; but it was not sensitive enough to feel the tremors above mentioned. While I stood at the table reading off my sheet, suddenly, without any apparent cause, the seismoscope magnet began to rattle. I immediately took the time from the clock, and, all corrections applied, it gives $11^h\ 14^m\ 41^s \pm 1^s$, eastern standard time, as the beginning of the signal. Mr. McNeill instantly went to his instrument, and found the mercury strongly disturbed: the reflected image was invisible at first, but the disturbance ceased in about

20 seconds, with a series of small north and south oscillations. My daughter, who was sitting in the second story of my house, at the same time (as proved by her mantel clock) felt the floor quiver, and heard the windows rattle. As the explosion, according to the New York papers, occurred at 11.13 ± some uncertain number of seconds, and as the seismoscope registered no other shock between 11.00 and 11.20, when traffic was resumed, there can be no doubt that we caught the explosion wave, which was much more vigorous than I had expected, at a distance of fully 50 miles. I suppose we did not get the beginning of the disturbance, which probably began gently and rose to a maximum like any other earthquake.

The delay of 13 minutes at New York was very unfortunate, and caused the total or partial loss of many valuable observations. One cannot suppose that it was intentional; but it put all other observers at a great disadvantage, as compared with those of the engineer corps, who received a telegraphic signal from the firing key. The officers in charge, knowing of the elaborate preparations made for observations along other lines than the two occupied by their own men, ought to have taken great pains to prevent it.

C. A. Young.

Princeton, N. J., Oct. 12.

False report of the fall of a meteorite in western Pennsylvania.

On the afternoon of Saturday, September 26, at a little after four o'clock, loud detonations were heard over a considerable area of western Pennsylvania, and circumstantial reports were subsequently given in the press of the fall of a large meteorite, which was described as being half buried in the ground and visited by numbers of people. On examination, these latter reports appeared to me to be unfounded, and I should have given the matter no further attention but for the numerous inquiries which are being addressed to this observatory with requests for specimens. To settle the question, I sent a competent observer, Mr. J. E. Keeler, to the scene of the alleged fall near the West Virginia boundary in Washington county. After an investigation on the spot, he finds that no meteorite has been found. A meteorite undoubtedly passed over, and was seen by Mr. Buckston and others to burst in a southerly direction from the town of Independence. The report, according to Mr. Buckston, was heard a minute or more after the explosion was seen, and from this and the apparent height at which he saw the meteor burst, Mr. Keeler infers that the actual explosion occurred twelve or fifteen miles to the southward, when the meteor was still two or more miles above the earth. In spite of statements to the contrary, no fragments are as yet known to be found.

S. P. Langley.

Allegheny, Oct. 7.

Spectrum of the great nebula in Andromeda.

A week or two since, the finding of bright lines in the spectrum of the great nebula in Andromeda, found place in your columns. Since then by the aid of the spectrum of β Lyræ and γ Cassiopeiae certain results have been obtained.

The line described in the last notice as crossing the spectrum is H β, and is due to the brightening of the aurora as a whole.

The two lines described as appearing as bright knots have wave lengths 5312.5 and 5594.0. Thus agreeing well within the limits of error with 1250 +20 and 1474 of the solar corona, lines which are also found in the auroral spectrum, and in the spectrum of a solar protuberance (Schellen. 2.136).

In spite of the uncertainties natural to the observation and identification, the resulting suggestion of a similar origin for the light of the new star is not without considerable interest. O. T. S.

Yale college observatory, Oct. 5.

Science in common schools.

Your notes on teaching science to children need qualifying, so far as inference is concerned. The boy of nine years was evidently badly managed, but a boy of nine with a good head is capable of comprehending physiology, botany, geology, biology, if properly taught. The chief difficulty with the case in hand was that his information led to a cuteness of intellect. He would be set down for a 'smart' boy. Of all the text-books for the young the one that best suits me is Shaler's 'Geology for beginners.' This I have allowed my nine-year-old to use during the past summer. He has talked over each chapter with me, and we have discussed matters as if both were boys, using simple words, but no tricks of illustration, such as your boy seems to have been indulged with. Occasionally he has been exercised in an attempt to tell the contents of a few pages where these together make one picture. In no case has he verbally memorized, except to clearly comprehend the division of protozoa, mollusks, articulates, vertebrates, and that of orders, species, etc. Having once finished a chapter, we reviewed it to call out new points and illustrations. This book has been his story book; he will not read an ordinary story when such material is at hand. To say he fully comprehends the theories advocated by Professor Shaler is not to say too much. As he is four-fifths of his time out of doors or working with his tools, it has been easy to make the soil and the stones under foot illustrate his book. Now, if any one will write as good a biology, the nine-year-old shall have that next; then botany and physiology. I am suspicious of pen-work at this early age. It is a precocious, unnatural cramping of a boy's knowledge into formal artistic shape. It involves the art of expression and the art of restraint, or a skill in leaving out as well as putting in. The boy would best be left to talk the subject over in free language.

But when shall pen work begin? Later; at about about twelve years or fourteen. Then let the lad have a portfolio and write something on any topic he is thinking about each day of his life. Nothing spoils a mind so quickly as composing, as nothing so assists if wisely managed. I should decidedly prefer that the first efforts of composition should be in the dramatic form. Let him set his characters talking, and put in their mouths the notions he has of them. For instance, Garibaldi, King Victor, Cavour, Louis Napoleon, or President Cleveland and his cabinet talking over the Indian question. Contemporaneous history being his regular historical study, his characters should be living characters, or mainly so.

The composition on iron ores is, however, a most excellent specimen of descriptive writing for a very

young pupil. It is, I take it, by a girl, though your article says a boy. But is there much real value in the exercise even when such clearness is attained?

I make it a conscientious matter from the first to answer all child questions about nature in a truthful manner. They are never put off with false theories involving supernatural or other agencies. For instance, what child fails by three to five years of age to ask how do the stars stay up there? How easy to put him off with some farcical or miraculous supposition. On the contrary, the simplest possible attempt should be made to give him the real explanation. Will he understand it? If not entirely, he will be on the right road. There will not be something to undo by and by. Why can he not understand attraction as well as you or I? Only he must have it explained by what he is familiar with.

We are getting on the right track. Science furnishes studies infused with romance. No novel has the fascination for young people of a well-told geology or biology. E. P. Powell.

The care of pamphlets.

Every scientific library, public or private, contains pamphlets by the thousand, and nothing is more necessary for the accommodation of those who use it than some available system of binding which shall preserve from destruction and at the same time be accessory to a convenient system of classification.

Some system of permanent individual bindings is needed which shall afford 1°. permanent protection; 2°. the possibility of a perfect classification, and the intercalation of new material from day to day; 3°. opportunity for perfect labelling and cataloguing; 4°. the greatest convenience to the reader. The best endowed public libraries can perhaps afford to pay a bookbinder to put separate covers on pamphlets, and it is the practice of many of them thus to care for the most important. The cost is, however, very considerable. What the private individual needs is a binding-case much more inexpensive—one in which he can himself insert his pamphlets. Feeling sure that it was possible to meet this need, I undertook an investigation. The bookbinders, with their skilled workmen and their expensive binder's board, did not seem to be in a position to supply this demand. I found upon inquiry that the simplest form of binding-case cost from twelve to fifteen cents. I next turned to the paper-box manufacturers, who employ unskilled laborers, and who use less expensive materials. I found that binders for octavo pamphlets, when ordered in considerable quantities, could be made for $4.50 a hundred, and quarto binders for $7.50 a hundred. These binders are made with sides of thick paper-pulp board, which is not likely to warp, and with backs of binder's muslin, and are covered with binder's paper. They have muslin stubs, upon which the pamphlets may be glued, and may be made of varying thickness. The most useful sizes will doubtless be one-eighth, one-quarter, one-half, three-quarters and one inch. The sizes I use are, octavo, 6 3-4x10 inches; quarto, 10x12 inches. The octavo covers are made larger than the ordinary octavo page, to include papers in imperial octavo; duodecimo pamphlets may also be put in these covers, for the sake of uniformity, and convenience in classification. Each binder has a blank label on one of its upper corners, upon which the name of its contents are written. I arrange these in paper boxes, upon ordinary book shelves, so placed that the contents of each box may be handled in the same manner as the cards in a card catalogue, the position of the title labels facilitating this operation. A system of deep drawers would be equally convenient.

I also use these pamphlet-cases for filing letters, photographs, newspaper clippings and other literary material. A stout manilla envelope being glued to the stub with its opening to the right, and next to the back, is covered and protected by the sides of the binder, and may be filled with loose papers, their character being indicated upon the label outside. The binder may then be arranged with the pamphlets or elsewhere. Classified scrap-books may very easily be made by fastening a few sheets of book paper to the stubs, and bundles of letters may be bound in in a similar manner. I have for years used binding-covers of a still cheaper and simpler form, which are simply sheets, 9 1-2x13, made of the stout, thick paper used in herbaria for genus covers. These are fastened to the pamphlets by the use of the patent staple-like paper fasteners, sold by stationers. They are labelled and arranged in the same manner as the binders, as described above, and serve an excellent purpose, the paper, though less indestructible than is desirable, being very stiff and durable. It is simply waste of time to use even the thickest of ordinary manilla paper for this purpose.

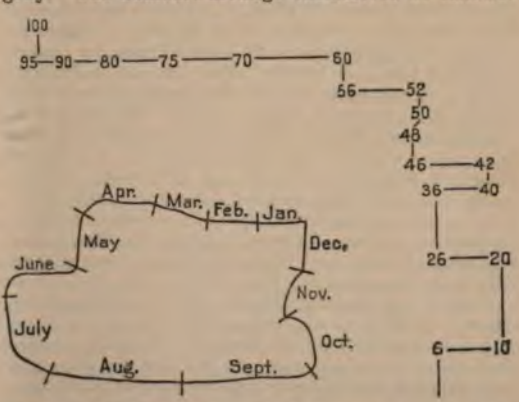
This note is sent in the hope that it may draw forth descriptions of other methods of caring for pamphlets. G. Brown Goode.

U. S. national museum, Washington.

Color and other associations.

In *Science* for the 18th of September, I was much interested in the letters on 'color and other associations,' for I have always experienced similar illusions. According to my fancy, the months have always appeared as below.

The days of the week are in the form of a circle, Sunday on top, Thursday below; the days rotating from right to left. Sunday appears yellow, Monday pale straw, Tuesday green, Wednesday yellow, Thursday orange, Friday black, and Saturday whitish gray. The numbers arrange themselves as follows:



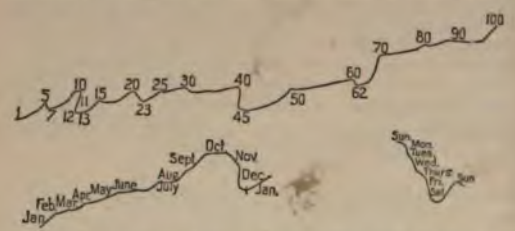
When I think of a number I always place it in the diagram. Above 100, the numbers go between the hundreds like the diagram, and the hundreds themselves follow a similar course.

In committing prose or verse to memory, the positions of the paragraphs fix themselves in my mind so firmly that when I recite I almost read the words from the air before me, unless I have learned them by ear, in which case there is no illusion at all.

Thatcher T. P. Luquer.

Bedford, N. Y., Sept. 28.

The matter of forms in series of numbers, months and days seems of considerable philosophical interest. Is there not herein a hint that, although to broad features, the great principles of mental states and operations are everywhere the same, yet the minutiæ may be utterly incongruous and irreconcilable, and hence, that in the minute analysis of these things philosophers must always in a measure fail, because the assumption on which all philosophy is built, that minds act alike, proves to be not wholly reliable? What seems a necessity of thought, or at least a constant accompaniment of thought to one, seems ridiculous and unthinkable to another. Such forms have existed in my own mind from my earliest remembrance, yet I never thought of them as other than naturally common to all, till within a few years,



finding them entirely wanting to some minds. The annexed diagrams show that, while the numbers and the months take in general an ascending direction, the days of the week have a steep grade downwards to my mind.

Silvanus Hayward.

Southbridge, Mass.

Some notes on color in *Science* recently recalled a study made by me when in Chicago a few years since. I was made president of the Kindergarten association when it was formed in 1875. This gave me occasion for several very curious lines of inquiry. Only one of these will be appropriately recalled now. A casual remark of that able teacher, Mrs. Putnam, led me to ask her which gift the children under seven first chose. She answered yellow. I said, "What, in preference to red or blue!" "Yes," she repeated. "with only one exception, invariably yellow." I then inquired of Miss Eddy, whose fine powers of observation were unequalled, and her answer was yellow. I could hardly believe it: but from every teacher there; or elsewhere, I have received the same answer, a few adding that they have had in charge a few children who were exceptions. This tallies with my recollections of my own childhood, and is confirmed by others. If it be an established fact, which I will not aver, to what shall we attribute it? Is it improbable that there is an unconscious relation between the growing child and the ray most concerned in growth, as there seems to be between old age and the red ray? We certainly outgrow at an early age our preference for the yellow.

E. P. Powell.

Clinton, N. Y.

Ball of electric fire.

Mr. J. V. Wurdeman says that a ball of fire, as large as a child's head, came into his room at Leavenworth, hopped across the floor like a soap bubble rolling on a carpeted floor, went out through the side of the house at the corner opposite to where first seen, with a sort of explosion, or rather puff, not nearly so loud as a pistol shot nor so sharp, and tore off the rain pipe of tin. It looked like an electric brush, not brilliant nor like the electric spark. His son, a little child, was playing on the bed: his mother snatched up the boy and was half way down stairs before the ball disappeared. The ball seems to have been like the St. Elmo lights, which I have seen on a vessel's yard arm, in the Gulf of Mexico, a pale brush of light, spherical in form, like the brush issuing from a metallic point in the prime conductor of the frictional electric machine.

M. C. Meigs.

Voss-Holtz electrical machine.

A few days ago I accidentally received a pamphlet on the theory of the Voss-Holtz electrical machine, by E. B. Benjamin, dealer in physical apparatus, New York City.

The article states that "no perfectly satisfactory explanation of all the phenomena manifested by this machine has yet been made public in this country," and then gives the theory that was published in *Science*, for June 20, 1884. In many places the sentences are the same, almost word for word, except that he has lettered the parts of the machine, and used the letters for the names of the parts.

Mr. Benjamin gives no credit either to *Science* or to the author, and further copyrights, by itself, the part of the pamphlet containing the theory, the date of the copyright being 1885.

H. W. Eaton.

Louisville, Ky., Oct. 2.

Carnivorous habits of the striped squirrel.

As the carnivorous habits of the musk-rat and other rodents have been under discussion during the past year, I wish to record a rather remarkable instance, which came to my notice in New Hampshire, May 27, 1883, in case of the striped or ground squirrel, Tamias striatus (L) Baird.

The chipmunk is usually regarded as a harmless vegetarian, living chiefly, if not wholly, upon nuts, fruits, and the seeds of grain and various plants; but this is probably not the whole truth of the matter, at least in the following case, for an account of which I am indebted to the Rev. F. M. Gray, of Plymouth, N. H.

On the morning of the day in question, he was in the woods, and stopped to listen to some bird, when his attention was called to a white-footed or deer mouse (Hesperomys leucopus, (Raf.) LeC.), which ran hurriedly past, carrying something in its mouth.

Suddenly a chipmunk, which had watched proceedings from a stump near at hand, pounced down upon the mouse, caught up what she had carried in her mouth, but had dropped through fright, and returning to his stump began to devour it greedily.

The captured prey could now be seen to be a young mouse, which the squirrel ate as he would a nut or a piece of apple, in this case beginning with the head.

r verify the fact, he frightened the chip- l brought home the half eaten young ich I examined, and found to be of the ove mentioned.

on our natural history have much to con- the carnivorous propensities of the red Sciurus Hudsonius Pallas), of the flying ciuropterus volucella, (Pall) Geoff), the rats s, but the chipmunk escapes without vitu-

of the food of the striped squirrel, Audubon Quadrupeds of North America,' "it prefers rye, seems fond of buckwheat, but gives to nuts, cherry-stones, the seeds of the red peridge (Nyssa multiflora), and those of sev- l plants and grasses." He mentions the ted to him by a Boston lady, of a ground ich was seen taking young robins from the is, he thinks, was an "unnatural pro- the individual," and did not indicate "the bit of the species."

Hart Merriam, in his 'Vertebrates of the k region,' says "the striped squirrel feeds riety of nuts and roots, and is fond of corn l kinds of grain." It is especially fond of , and stores up the seeds of various plants, buttercup; eats the tubers of the ground a trifolia), and the yellow 'kernels' of rn (Dicentra Canadensis). He quotes from in the *American naturalist*, who saw a "busy nibbling at a snake that had been illed. He could hardly be driven away, returned to his feast when his tormenters rawn a short distance."

monly known that the red squirrel is car- o the extent of eating coccoons of insects ng, devouring bird-eggs, and even taking birds from the nest; and it is quite pos- he chipmunk, which is rarely seen in trees, e emboldened to treat the smaller ground- rds in a similar fashion. The wholesale of birds, which is often rightly attributed squirrel, may be shared in to some extent, the no less active Tamias.

F. H. Herrick.

cent Proceedings of Societies.

emy of natural sciences, Philadelphia

Mr. Charles Morris made a communication ject of attack and defence, as determining imal evolution. In considering the develop- dermal skeleton of animals, with its vari- ations, we are led almost to the conception e has been controlled at successive periods ideas, each dominant during a long period abandoned in favor of a new one. We ure that the first appearance of fossils in does not indicate the first appearance of he earth. Early fossilization is due to the n of the dermal skeletons of animals of ly advanced organization, and these were bly preceded, during a long era, by soft- ms of low organization, which could leave f their existence, except in the case of the worms. The development of an external eems to have come like a new idea to l was adopted simultaneously, as it seems, obably at considerable intervals by the various types of life. At a later era, the prevailing tendency is not to assume armor but to throw it off. The labyrinthodont amphibians were clothed in armor, their heads in particular being protected by hard, bony plates. Modern amphibians are naked-skinned animals. The reptiles are usually scaled, but with the exception of the crocodiles and turtles and some few fossil types, they do not seem to have been clothed in bony armor, while in the birds and mammals all defensive armor is lost. The same tendency to pass from the armored to the unarmored state is seen in invertebrate life. These changes were held to have taken place in consequence of the reciprocal influence of attack and defence. If a food animal gained some structural feature which gave it an advantage over its carnivorous foes, the latter would be at a disadvantage until they had gained equivalent features. So, if a carnivorous animal gained some habit, motion, or weapon, which gave it an advantage in destroying, this must have acted as an incitement to a corresponding development in food animals. Illustrative facts were freely given to support the belief that four successive ideas emerge into prominence in the development of the animal kingdom. In the primeval epoch it is probable that only soft-bodied animals existed, and the weapons of assault were the tentacle, the thread cell, the sucking disk, and the like unindurated weapons. At a later period, armor became generally adopted for defence, and the tooth became the most efficient weapon of attack. Still later, armor was discarded, and flight or concealment became the main methods of escape, and swift pursuit the principle of attack, while claws were added to teeth as assailing weapons. Finally, mentality came into play, intelligence became the most efficient agent both in attack and defence, and a special development of the mind began. As a culmination of the whole, we have man, in whom mentality has replaced all other agents in the struggle for existence. But side by side with man all the other types exist, the soft-bodied, the armored, the swift moving, and those in which cunning precedes the higher mentality. In the existing conditions of life on the earth, we have an epitome of the whole long course of evolution. Prof. Heilprin, while agreeing in the main with Mr. Morris's arguments and deductions, remarked the occurrence of certain conditions among early organic forms, which, from the position defined, would be anomalous. The Cambrian trilobites, the largest organisms apparently of their time, were already clad in very perfect armor. Was this the result of evolution without the necessity for defence? The most highly armored ganoid fishes are those of the shortest period of existence. The huge carboniferous amphibians are cased in armor, without the existence of contemporaries at all powerful enough to inflict damage on them; while at the present time the unprotected ant eater lives side by side with such armored forms as the armadillo.——Mr. Redfield called attention to the fact that in the vicinity of Mt. Desert the traces of glacial action were very obscure, and stated that this had been accounted for by the theory that the region had been submerged for a sufficient length of time to remove the striæ from the softer rock. On the hard quartz veins the scoring was evident, while farther inland the slates and softer deposits bore clear traces of glacial scratching. The subject was further considered by Mr. Aubrey H. Smith and Prof. Heilprin, the latter holding that the geologists were apt to

push the theory of submergence too far in accounting for such phenomena.

Calendar of Societies.

Boston society of natural history.

Oct. 7.—Dr. S. Kneeland, The family-life of the Norwegian Lapps, and the habits of the reindeer.

Society of Arts, Boston.

Oct. 8.—Prof. W. T. Sedgwick, The relative poisonous properties of (illuminating) coal and water-gas.

Cambridge entomological club.

Oct. 9.—George Dimmock, An account of his mode of rearing larvae of Coccinellidae.

American academy of arts and sciences, Boston.

Oct. 9.—Mr. Seth C. Chandler, Jr., On the square bar micrometer.—Prof. Arthur Searle, On the apparent position of the zodiacal light.—Messrs. Chas. R. Cross and James Page, The measurement of the strength of telephone currents.—Prof. Charles R. Cross, The thermal telephone.

Publications received at Editor's Office, Oct. 5–10.

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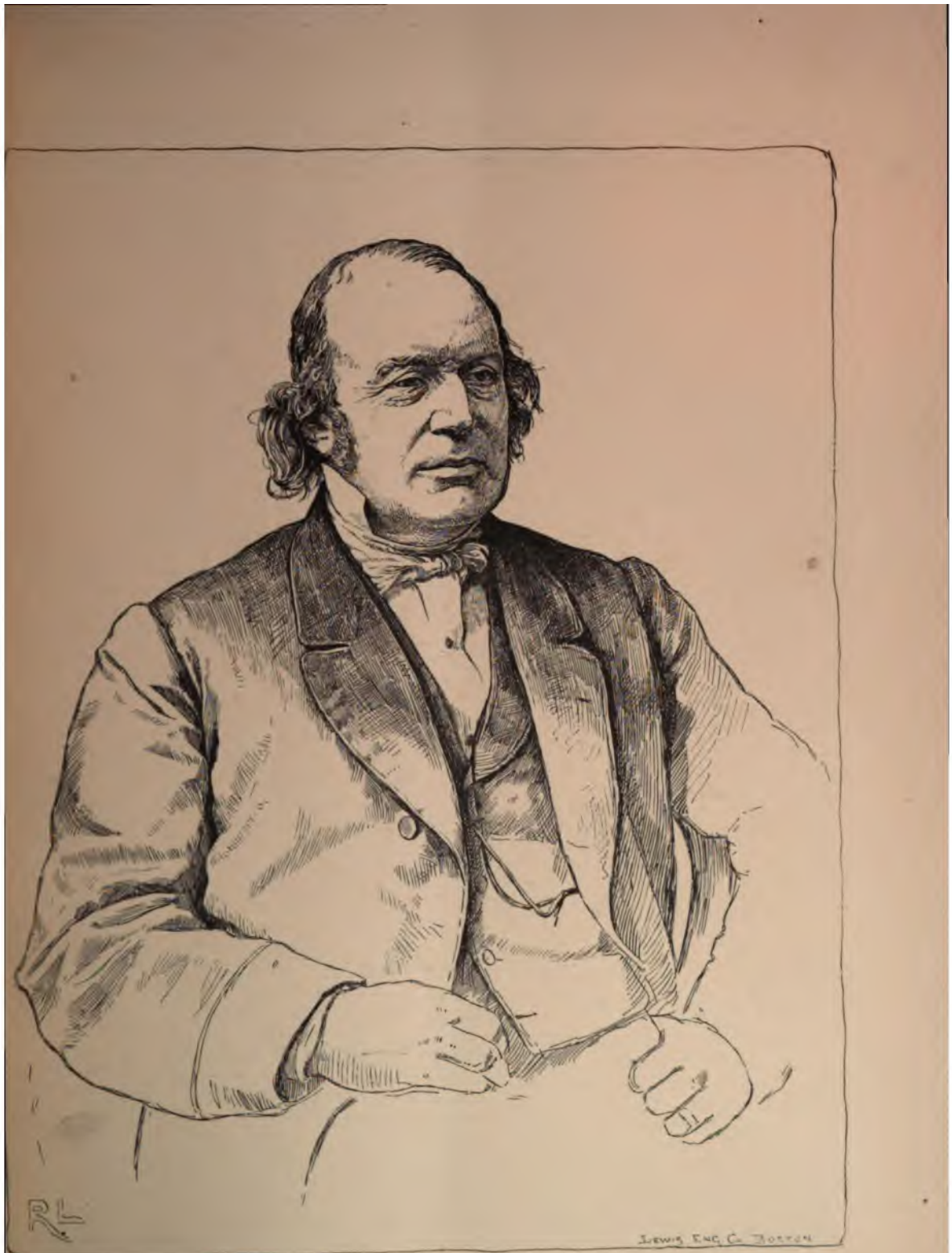
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naturally and economically supplied Bessemer works in our manufacturing magnitude of whose operations enables tably employ the best talent and ma- to produce at the smallest cost, geo- nditions occasionally favor the erec- steel works; for example, where a nd for Bessemer steel, too limited to rection of full sized works arises in a from all existing Bessemer works, ig-iron is cheap, owing to the imme- of iron blast-furnaces. Here it might convert the local pig-iron into steel even if they be so small that the ent is somewhat high, than to trans- to distant works, have it there con- el, and then bring it back to the

cases several small and compara- rangements of the Bessemer plant gned, and one of these, the Clapp- kindled quite a glow of interest which judicious and energetic offing bid fair to convert into a Since the arrangement aims ively small output, some sacrifice heapness of working are properly diminish the cost of the plant rotating converters of the ordi- replaced by the cheap Swedish er. The blast is introduced, not converter at the bottom of the but near its upper surface, so resistance to overcome, blast at hence furnished by cheap blow- suffice. Moreover, towards the n and while the steel is being onverter, the blast is admitted l 'over-blowing'; and a hole hell of the converter at such a runs out through it during the I mention these latter de- supposed to play an import- part in the chemistry of the plant itself, of good but not of interest to the readers of ne it is claimed that it re- iformly and completely than plant does. The effect of steel brittle has long been the proportion of carbon of phosphorus which would eel containing only 0.15% teel with 0.5% carbon from to a worthless brittle one. ined that silicon *counter-* horus, many have long believed that like carbon it greatly *exaggerates* them. This belief is somewhat strengthened by the fact that phosphoric samples of Clapp-Griffiths steel, when low in both carbon and silicon, are surprisingly ductile. But whether their ductility be due merely to low carbon or to the combination of low carbon with uniformly low silicon, it is interesting to inquire whether it be due to conditions which can be regularly imitated in the large scale Bessemer works; if it be, then, since the magnitude of their operations enables them to produce more cheaply, an important if not the chief ulterior result of the development of the Clapp-Griffiths plant and practice will probably be to teach the metallurgists of our large works how to produce more uniformly ductile steel from given pig-iron, and, aiming at a given degree of ductility, to employ more phosphoric, and hence cheaper, pig-iron than heretofore. Let us, therefore, consider the explanations which have been advanced of the results obtained in the Clapp-Griffiths practice.

1. The uniformly thorough desilicidation has been attributed to the unusually low blast pressure employed. While it is conceivable that, by increasing the tendency of carbon and oxygen to dissociate this might favor the oxidation of silicon, this explanation seems far fetched and insufficient. But, if low blast pressure be the cause, the ordinary Bessemer works can employ it by making their vessels wider and the bath of metal shallower than at present.

2. It has been attributed to admitting the blast near the top instead of at the bottom of the bath of metal; this is supposed to cause a local excess of oxygen in the upper part of the bath with the formation of iron-oxide (the copious evolution of red smoke at the commencement of the operation is adduced as evidence of this) which is supposed to attack silicon rather than carbon. But the early appearance of iron-oxide in the flame of the Clapp-Griffiths converter may indicate, not that it is a more active, but actually a less active agent than in the ordinary converter (I will not pretend to say what its true significance is). If we confine our ideas to a very minute quantity of metal immediately in front of any one tuyere of the ordinary converter we realize that, in this restricted space, oxygen is nearly, or perhaps quite, as much in excess as it is in a similar space in front of a Clapp-Griffiths tuyere. If iron-oxide forms in the latter, it will also, and perhaps to an equal extent, in the former. We do not see it escaping from the ordinary converter, probably because it is reduced by the carbon and silicon and slagged by the silica it encounters in its long upward path through the superincumbent metal, while in the Clapp-Griffiths converter, dragged along by the blast, its

They certainly show that the time for optimistic congratulations is not yet reached.

The other general conclusion of the report that such falling off in health during college life, as did appear, is due rather to predisposing causes, than directly attributable to college life itself, brings out some very interesting contributions to the scanty generalizations we already possess, concerning the relations between health and social environment. First as to heredity: A total of 35 per cent report a tendency to disease inherited from one or both parents. Those inheriting tendency from one parent only present some slight falling off in good health when compared with the entire average; while for those inheriting from both 58.3 per cent are in good health; 41.7 in poor, the average for all being 83 and 17 per cent respectively. For the 65 per cent inheriting tendencies from neither the figures are 85 and 15. As to relative change there is for those inheriting from both a relative decrease of 19.5 per cent in those having excellent health; an increase of 24.6 per cent in those having poor; the corresponding figures for those inheriting from neither being an increase in good health of 2.6 per cent, a decrease of poor of 1.6. The following tables show the effects of exercise, worry and study upon health:

EXERCISE.

Hours taken.	Health.	
	Good.	Poor.
	Per cent.	Per cent.
0—2	75	25
2—6	83	17
6 and over	84	16

WORRY.

Concerning.	Health.	
	Good.	Poor.
	Per cent.	Per cent.
Study	80	20
Personal affairs	75	25
Both	68	32
Neither	92	8

The differences in the last two results furnish one of the most interesting contributions yet made to the student of sound sanitary, social, and moral conditions.

STUDY.

Amount.	Health.	
	Good.	Poor.
	Per cent.	Per cent.
Moderate	85	15
Moderate to severe	83	17
Severe	79	21

The report upon the whole is surprisingly full. For the social student, however, it presents certain notable deficiencies. The physi and moral environment of the studen college requires infinitely more investiga details concerning intellectual surroun comparatively full, though the number of study should be given instead of the terms, 'moderate,' 'severe.' The inqu cerning social surroundings are virtually to the inquiry as to whether the person society,' a little, a good deal, or none. S expressions are worse than none. The is as to how the student spent the hour recreation, and how many were so spe complete answer of this question, it is much to say, would throw more ligh hygienic problem than almost all else. include information as to whether the i is female only or co-educational; what relations are to the town in which it is the nature of the town; whether the you live in dormitories, in cottages, in selecte or in ordinary boarding-houses; what re if any, the faculty have made concerni hours, and the hours not spent in study the institution has a matron; whether t extend to moral and social matters, or to only; whether the institution has a gy etc. Complete answers to such a pr questions as these suggest would show meant by saying that 81 regard bad sani ditions as cause of their diseases, 135, tional weakness, and 73, emotional s the association will study the conditor problem along this line, and frame accordingly, they will deserve still mo hands of both the scientific educator, and student. Meanwhile we will be thankful we have.

JOHN I

THE CLAPP-GRIFFITHS BESSE PLANT.

THE Bessemer process of converting mo iron into steel by oxidizing and removin bon and silicon by blowing immense vo air through it, appears to be entering a ne Aiming for many years almost solely at duction of rails, the captains of the Bessen try found it much easier to satisfy the de purchasers as to the quality of their pro those of their employers as to its quantity arose the present type of Bessemer plant, no expense of construction is spared whi ises to increase the quantity and thus to the cost of the product. To-day, how uses of Bessemer steel are being rapidly and diversified. While most of the new

can be most naturally and economically supplied by the large Bessemer works in our manufacturing centres, the magnitude of whose operations enables them to profitably employ the best talent and machinery and to produce at the smallest cost, geographical conditions occasionally favor the erection of small steel works; for example, where a special demand for Bessemer steel, too limited to warrant the erection of full sized works arises in a place remote from all existing Bessemer works, and where pig-iron is cheap, owing to the immediate vicinity of iron blast-furnaces. Here it might be cheaper to convert the local pig-iron into steel at local works, even if they be so small that the cost of treatment is somewhat high, than to transport the iron to distant works, have it there converted into steel, and then bring it back to the starting point.

To meet such cases several small and comparatively cheap arrangements of the Bessemer plant have been designed, and one of these, the Clapp-Griffiths, has kindled quite a glow of interest in this country, which judicious and energetic fanning and puffing bid fair to convert into a veritable craze. Since the arrangement aims at a comparatively small output, some sacrifice of rapidity and cheapness of working are properly made in order to diminish the cost of the plant itself. The costly rotating converters of the ordinary plant are replaced by the cheap Swedish stationary converter. The blast is introduced, not as in the ordinary converter at the bottom of the deep bath of metal, but near its upper surface, so that, having little resistance to overcome, blast at low pressure, and hence furnished by cheap blowing apparatus, may suffice. Moreover, towards the end of the operation and while the steel is being tapped out of the converter, the blast is admitted very slowly, to avoid 'over-blowing'; and a hole is provided in the shell of the converter at such a height that the slag runs out through it during the converting operation. I mention these latter details because they are supposed to play an important and unlooked-for part in the chemistry of the process; indeed, the plant itself, of good but not remarkable design, is of interest to the readers of *Science*, chiefly because it is claimed that it removes silicon more uniformly and completely than the ordinary Bessemer plant does. The effect of phosphorus in rendering steel brittle has long been known to increase with the proportion of carbon present. A percentage of phosphorus which would have little effect on steel containing only 0.15% carbon would change steel with 0.5% carbon from a valuable ductile metal to a worthless brittle one. While some have maintained that silicon *counteracts* the effects of phosphorus, many have long believed that like carbon it greatly *exaggerates* them. This belief is somewhat strengthened by the fact that phosphoric samples of Clapp-Griffiths steel, when low in both carbon and silicon, are surprisingly ductile. But whether their ductility be due merely to low carbon or to the combination of low carbon with uniformly low silicon, it is interesting to inquire whether it be due to conditions which can be regularly imitated in the large scale Bessemer works; if it be, then, since the magnitude of their operations enables them to produce more cheaply, an important if not the chief ulterior result of the development of the Clapp-Griffiths plant and practice will probably be to teach the metallurgists of our large works how to produce more uniformly ductile steel from given pig-iron, and, aiming at a given degree of ductility, to employ more phosphoric, and hence cheaper, pig-iron than heretofore. Let us, therefore, consider the explanations which have been advanced of the results obtained in the Clapp-Griffiths practice.

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travel to the upper surface of the metal is so great that it does not have opportunity for complete reduction and slagging. Now iron-oxide can only remove silicon by being reduced by it, or by combining with already formed silica and thus preventing its reduction. Its appearance in the flame of the Clapp-Griffiths converter at a period when it is absent from that of the ordinary converter may indicate, not that it is formed more copiously, but that it is reduced and slagged less completely in the former than in the latter.

3. It has been attributed to the partial removal of the slag (whose silica might have been reduced had it remained as it does in the ordinary converter) during the converting operation. But the slag can be removed from the ordinary large rotating converters as well, and without serious expense or trouble, by turning them down 90° and skimming it at any desired stage of the process.

4. Finally, there are scoffers who say, "We believe that the removal of silicon bears the same relation to that of carbon in your converter as in the ordinary converter. Your analyses, apparently intended to show that your converter specially favors the removal of silicon, do not even point in that direction. The ductility of your phosphoric steels is indeed due to their being uniformly low in carbon and silicon. But this in turn is due to your admitting the blast so slowly towards the end of your operation that you can hit the point of complete removal of carbon and silicon more accurately than we can in our large converters with our present practice of blowing rapidly to the very end. But many feasible plans at once suggest themselves by which we may accomplish this in the ordinary converters. Creditable statements that at least one large scale Bessemer works is actually producing steel as uniformly low in carbon and silicon as yours, strengthen this belief."

It is too early to decide positively which, if any, of these explanations is the true one. If any of them be, it is highly probable that the excellent metallurgical results of the Clapp-Griffiths practice will be successfully imitated by the large Bessemer works.

The validity of the claim that the Clapp-Griffiths steel is superior to that of identical composition made in the ordinary converter can only be admitted on the production of far more conclusive evidence than has yet been offered.

HENRY M. HOWE.

ACTIVITY OF THE MIND DURING SLEEP.

IN connection with the present activity in psychical research, the following extract from the recently published 'Life of Agassiz' (Boston, *Houghton, Mifflin & Co.*) is of interest:—

"He [Agassiz] had been for two weeks striving to decipher the somewhat obscure impression of a fossil fish on the stone slab in which it was preserved. Weary and perplexed he put his work aside at last, and tried to dismiss it from his mind. Shortly after, he waked one night persuaded that while asleep he had seen his fish with all the missing features perfectly restored. But when he tried to hold and make fast the image, it escaped him. Nevertheless, he went early to the Jardin des plantes, thinking that on looking anew at the impression he should see something which would put him on the track of his vision. In vain,—the blurred record was as blank as ever. The next night he saw the fish again, but with no more satisfactory result. When he awoke it disappeared from his memory as before. Hoping that the same experience might be repeated on the third night, he placed a pencil and paper beside his bed before going to sleep. Accordingly, toward morning, the fish reappeared in his dream, confusedly at first, but, at last, with such distinctness that he had no longer any doubt as to its zoölogical characters. Still half dreaming, in perfect darkness, he traced these characters on the sheet of paper at the bedside. In the morning he was surprised to see in his nocturnal sketch features which he thought it impossible the fossil itself should reveal. He hastened to the Jardin des plantes, and, with his drawing as a guide, succeeded in chiselling away the surface of the stone under which portions of the fish proved to be hidden. When wholly exposed, it corresponded with his dream and his drawing, and he succeeded in classifying it with ease. He often spoke of this as a good illustration of the well-known fact, that when the body is at rest the tired brain will do the work it refused before." (p. 181.)

DEATHS FROM WILD BEASTS AND SNAKES IN INDIA.

From time to time the Indian government issues reports on the yearly loss of life by snake-bite and wild beasts,—reports which still show a frightful mortality from these causes, and afford significant evidence that the present precautions and exertions of the government in this direction still fall wide of their object. The latest intelligence in the *Gazette* states that in 1883 about 22,000 men died from the above mentioned causes. The returns from the district authorities can by no means be considered complete and satisfactory, since in consequence of the apathy of the natives and the almost universal belief among them in kismet, or predestination, many cases are not reported at all

Translated from *Das Ausland*.

and escape the knowledge of the authorities. It must be remembered also that the records of the government include only the cases occurring in British India, while there is no record whatever of the mortality from these causes in the independent states like Jeypoor, Gwalior, Rewah and many others, which are governed by independent rajahs or princes. The British system of dealing with wild beasts and harmful reptiles has not yet been introduced into these large districts; and the natives do not encourage by premiums and rewards the extermination of tigers, panthers, and various cat-like animals, as they do that of cobras and other poisonous snakes; whereas in British India their destruction has become a trade and means of support. Accordingly it happens that in the more distant parts of India which are not yet under British rule, the mortality from these causes is about as great as it was before the British supremacy over India.

Among the animals so destructive of human life, the tiger naturally stands first, and the report of 1883 lays to his charge not less than 985 deaths; and yet this animal, if it remains undisturbed and is not irritated, seldom attacks men. Tigers as a rule are cowardly, and are only too glad to steal away at the approach of man. In earlier times, and this is especially true of British India, when tigers were more numerous than they are at present, so-called man-eaters were by no means rare among them. They were so named because after once tasting human flesh they were said never after to eat other meat. At that time it was not unusual to hear of unused highways, of large stretches of land left uncultivated, and of abandoned villages falling into ruins, because the ravages of this fearful animal drove away the inhabitants. To-day these man-eaters are almost exterminated; if one is heard of, the attention of the authorities is soon drawn to his actions, a hunt is organized, and usually the animal is soon killed by the rifle of a European sportsman or the gun of some private hunter.

The question naturally arises, if the man-eaters are so rare, how does it happen that in a single year almost a thousand men lose their life from tigers? In the first place it cannot be doubted, although tigers eating only men are now fortunately rare, that a tiger if he is surprised in his lair, or comes face to face with a man in his wanderings, under the impulse of the moment and perhaps more from fear than any other reason, knocks the man down and then goes off. Cases of this kind frequently occur in wooded regions. A tigress with young is especially dangerous, and often attacks unprovoked any one approaching the place where her young are.

Again, herdsmen, or gwallas, as they are called in Bengalee, frequently lose their lives, if, in their exertions to rescue one of their herd from the claws of the destroyer, they too greatly expose themselves. In such cases the tiger is very dangerous; he has perhaps already tasted blood, and will usually give up his booty only after a struggle. If several men, arranged in a compact form, press upon him, as, ready to spring, he cowers on the ground behind the bull slain by him, he will often slowly and unwillingly retreat, but often, too, made furious by the sticks and stones thrown at him, and by the cries of his bold antagonists, he will break forth to the attack with enraged cry and blazing eye, and knock down one or more of them.

The chief cause of death by snake-bite is the almost universal custom among the poorer classes of natives of travelling in the hot season by night, without torches or lanterns. The European in India never does this; if he wanders by night about his bungalow or house, or in his garden, he carries a lantern, on his nightly journeys a burning torch, which snakes are known to avoid. To be sure, cobras are night animals; by day one seldom meets them. but after sunset they come out of their hiding places to seek food. A native usually goes barefooted, or wears a low shoe which protects neither ankle nor leg. In the dark he steps on or pushes against a poisonous snake, is bitten, or rather struck at, and probably by daybreak lies dead at the side of the road.

The same careless custom of wandering after sunset through jungles which are inhabited by wild beasts of all kinds, is, although in less degree, a constant source of danger only too frequently involving death. As already remarked, a tiger, if he is left undisturbed, seldom attacks man in the daytime, but much oftener, if unprovoked, creeps away with an angry growl. This rule does not apply to encounters by night. All rapacious animals go at that time for prey, and appear to be fully conscious of their advantage over man in their sharper vision adapted to the thick darkness of night. Consequently there is for the traveller not only the greater probability of meeting dangerous beasts of prey if he traverses the forests by night, but the tiger and the other rapacious animals of the forest are then bolder and more to be feared; and although the tiger is by nature cowardly, yet under the protection of the darkness and the impulse of hunger, the sound of human voices in the stillness of the night may attract him nearer to the road, and a crowd of unarmed natives, passing only a few arms lengths from his lurking place, may arouse still further his wicked instinct. If the temptation prove too great, with

a single spring he alights upon one of the unfortunate travellers, and bears off his shrieking victim.

We learn from the *Gazette* that in 1883 not less than 47,487 cattle were destroyed by wild beasts, and it cannot be doubted that in this connection the tiger is especially destructive, and from this cause there is a very heavy tax on the natives dwelling in villages near large forests. A couple of royal tigers will probably within a month kill and consume ten or twelve grown oxen or cows, and a tigress with two or three almost grown young is perhaps even more destructive, for she takes pleasure not only in killing for the nourishment of her young, but will often kill several at a time out of pure malice.

There are tigers which live almost entirely upon large animals like deer and boars, and only rarely approach villages and human settlements; rather the majority of them depend for support upon domestic cattle, and that is not to be wondered at. The ruminating animals of the forest are shy, restless creatures, ever on the watch for danger, and so careful that a tiger, in spite of his cunning and noiseless approach, never succeeds in springing upon such animals and in successfully tearing them down. The tiger is more fortunate if he lies down in the neighborhood of a spring in the jungle, and there hidden, awaits the deer coming after a long hot day, half dead with thirst, impatient of the approach of night, and careless, in order to obtain the long-desired water.

But a tiger soon discovers that he can obtain his food with much less trouble and exertion, if he attacks herds. This is not only easier, if the herd pastures at the edge of a jungle,—quite unlike deer, which are always cautious, and in a trice in flight if they scent the enemy,—but a herd of cattle moved by fear will stand as if bound, with their whole attention directed to the striped robber, when crouching to the ground he quickly approaches to springing distance. Then, when flight is too late, the foolish animals try to escape, but with a single spring the tiger is among them, seizes his victim with his powerful grasp, tears it down, and kills it with one bite of his strong jaws.

The Asiatic lion, which is still found in a few provinces, in Cutch, Guzerat, and a few parts of Bombay, but is rather rare, was formerly considered by naturalists on account of a single characteristic peculiarity (namely, the almost entire lack of a mane in the males and his smaller size), as a species different from the African lion; but they are now considered identical. Little is known of the manner of life and the habits of the Asiatic lion. Hunters describe him as a dangerous animal when pursued; but if not provoked or attacked, he appears, like the tiger, to avoid as far as possible, encounter with man; and apparently at nightfall he is not so bold and dangerous as the African lion. On the other hand, a lion, creeping along on the ground in the grass or in the undergrowth, even in comparitively open country, is much more difficult to distinguish than a tiger, because his brown spots resemble the color of the surroundings. It should be stated that it is a mistake to suppose that the lion in his natural state has the long flowing mane which we see in the caged specimens. Lions often live in close thorny thickets, and their manes, through the constant combing on the thorns, and the tearing in passing briery bushes, become thin and short, and lack the flowing abundance which pleases us in the caged animal. Like the tiger, the lion destroys cattle, but seldom or never eats men.

The panther and leopard in many things resemble the tiger: they seldom attack man, unless they are provoked, driven into a corner, or wounded, when, like all cat-like animals, they become very dangerous. Occasionally, though fortunately rarely, cases are reported when both animals show an unusual ferocity, and become man-eaters. For many experienced Europeans, and even for the native hunter, the Central Asiatic panther, a large, powerful beast, is far more dangerous than even the royal tiger, and both panther and leopard climb with agility, a power fortunately denied tigers and lions. Only a few years ago, it was reported that an English officer and a native hunter fired at a panther from the top of a tree, and wounded him severely. The panther climbed the tree, dragged the unfortunate Englishman down, mutilated him so that he died shortly after, and then mounted the tree again, and killed the hunter.

The panther, like the tiger, preys upon cattle; the leopard especially troubles the sheep and goats of the villagers, and often takes up his station only a few hundred feet from the village. Especially since the Indian mutiny, when the country was disarmed, and in mountainous regions, leopards have increased to an unusual degree. Formerly each village possessed two or three guns; now only certain people obtain permission of the government to carry arms, and consequently not enough animals are killed. The leopard has special designs against dogs, which he carries off zealously; often he will not attack a strong dog, but creeps up to him unnoticed and waits for a favorable opportunity to seize him, and to leap upon his neck, when he seldom looses his hold until the strength of the victim is exhausted. Notwithstanding the iron collar furnished with points which these valuable dogs wear, they are often

carried off by the leopards in the valleys of the Himalaya.

Among Indian beasts of prey there are three kinds of bears; two of them, the brown and black Himalaya bears, are found only in the mountains of northern India. The third kind, Ursus labiatus, is found only on the plains or in the lower mountain-passes, as in the Neilgherries of Madras. This last is not a flesh eater, but lives principally on wild fruit, various roots, grain, ants and honey. The two mountain bears, on the contrary, are undoubtedly beasts of prey and kill and consume as opportunity offers, sheep, goats and cows, a large number of cases occurring every year. Woodmen are often brought home frightfully torn and mangled, and at times cases are reported when a bear has attacked a man without the least provocation. A she-bear with young is more eager than any other animal to keep men from the neighborhood of her young; she will furiously attack any one who approaches them, and will pursue him, and wound him seriously with her teeth and claws; but a case has never been heard of, although often mentioned in books, where she engaged in close combat and attempted to crush her victim in her strong embrace. Indian bears are especially night animals, but they are frequently met with in the daytime, especially during the rainy season when the grass and jungles are thick and overgrown. At these times, and in distant places, where the forests are little travelled, one may easily come across the black bear seeking acorns under clusters of oaks, or bending down boughs to obtain the fruit, and it is not at all rare to see a bear trotting toward one in the open highway. But if he is only left alone, as a rule he will seldom trouble a man.

To complete the record another four-footed animal must be mentioned, namely, the bheria or Indian wolf, to which many men and animals fall victims. There is something especially abominable in his character, for he scarcely ever ventures on a man or woman, but makes children his prey. In some of the northern provinces of India, especially in Oude, and in some parts of Rohilcund, and also in the whole northwestern province of Bengal, the loss of human life by the wolf is very great. While the larger cat-like animals, as the tiger, lion, panther, and leopard, are night animals, the wolf, belonging to the dog tribe, is a day robber. At night he carries off little children from their beds, or from the side of their parents, if they sleep in the open air. The natives state that if a wolf has once tasted human flesh, he afterwards specially desires it, and touches almost no other food. A wolf usually lies in ambush in the immediate neighborhood of a village, in a cornfield, or in a strip of sugar-cane, and here bides his time, and watches a company of naked children at play, until by chance one of them gets separated a little from his playmates and approaches the wolf. Then a sudden shriek is heard, and a brown object is seen fleeing in all haste; very rarely can such a child be saved, for the wolf generally strangles it long before help can be rendered. According to the natives, the Indian wolf is so sly and cautious that he is never caught either in ditches or in traps.

AN AFRICAN SMITHY.

In his account in the London *Graphic* of his journey to Kilima-njaro, Mr. H. H. Johnston describes a native forge:—

The Ma-Chaga are clever smiths, and forge all kinds of utensils, weapons and ornaments from the pig-iron they receive from the country of Usanga,

AN AFRICAN FORGE.

near Lake Jipé. The forge is but a pair of goat-skin bellows, converging into a hollow cone of wood, to which are added two more segments of stone, pierced through the centre, and ending in a stone nozzle, which is thrust into the furnace of charcoal. The bellows are kept steady by several

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THE INDUSTRIES OF SIBERIA

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pegs thrust into the ground, and a huge stone is often placed on the pipe to keep it firm. After the iron has been heated white hot in the charcoal, it is taken out by the iron pincers and beaten on a stone anvil. The Chaga smiths not only make spear-blades and knives of apparently tempered steel, but can fabricate the finest and most delicate chains.

THE INDUSTRIES OF SIBERIA.[1]

In the region of the Amoor, the industries are of very small extent, chiefly on account of lack of means of transportation. The only possible communication at present is upon the rivers, and is completely closed during a great part of the year, when the rivers are impassable for both boats and sledges. This is unfortunate, for on the borders of this immense territory lie important industrial interests.

At the sources of the tributaries of the Amoor are gold mines; Kamchatka and the neighboring islands produce valuable furs; the island of Saghalin has rich and excellent coal deposits. Moreover, in the southern part, in the so-called Usuri region, are rich timber-lands and some land even capable of cultivation. The pursuit of these industries, with the fisheries and coal-mines, would make this Usuri region a valuable source of revenue; at present, however, they are very slightly developed, and that mostly by Americans and Chinese, rather than by Russians. The latter, however, are making strenuous exertions to colonize the territory, and thus avail themselves of its resources.

The industries of the two western provinces, Tobolsk and Tomsk, are somewhat farther advanced; these two provinces contain over 80 per cent of all the manufactories of Siberia. According to the official reports there are 2,300 of these, of which 1,460 are in Tobolsk and 660 in Tomsk. In all 12,500 hands are employed, and 14,000,000 roubles value produced annually. The most important class of manufactures is that which uses raw animal materials,—dyeing and tallow rendering establishments, etc. The class next in importance includes the distilleries, breweries and flour-mills. Besides these there are numerous soap, candle and glue factories, carriage factories, rope walks, felt-boot making establishments, etc. These latter can scarcely be called factories, but are rather of the nature of small work-shops. Except the mines and the smelting works closely connected with them, there is very little manufacture of mineral products in Siberia. There is one exception in the case of considerable glass works, which produce 200,000 roubles worth annually. There are also small potteries and brick kilns. The only textile manufacturing worthy of notice is done at a single establishment in Tjumen, which produces annually 200,000 roubles worth of army cloth. The needs of the people in this line are almost entirely supplied by household manufactures. Many knit and woven woollen articles prepared in this way find a market even in European Russia.

In all the Siberian manufactures, there is almost no national division of labor or management of capital. The same person is often both capitalist and laborer, and the production of the raw materials goes hand in hand with the manufactures. The manufactories are distributed here and there about the country, where the raw material is to be had to the best advantage, for transportation is difficult and costly.

Many products, even those which have a wide demand, produce a bad impression on account of their clumsiness and tasteless execution. The low standard of living and education among the peasants, who are the principal customers, is the main cause of this. For instance, in a town of Tobolsk are produced coarse, clumsy muskets with flint locks, which, nevertheless, find a ready sale at a good price, even as far as East Siberia and Amoor.

In general, however, manufacturing has taken many steps in advance in Siberia within the last fifteen years. In many places machinery has taken the place of hand labor, better processes in tanning, dyeing, etc., have been introduced, and a general improvement is noticeable in the quality of all the the productions. With better means of transportation and an infusion of European enterprise, Siberia will yet contribute an important share to the resources of the world.

[1] Condensed from an article in the *Oesterreichische monatschrift für den Orient.*

— According to the Indian papers Dr. Aitchison has made an extensive botanical collection in Badghis and Khorassan, in Persia, and when last heard of was at Turbat, on the Perso-Afghan frontier. He is said to be very anxious to transfer his collections, which number 600 species, to Kew. His researches have been directed, not merely to the collection of plants, but to ascertaining the uses to which they are put locally.

— The rapidity with which stalactites are formed under favorable condition is well shown in St. John's Gate, Quebec. This old gate in the walls of the city was rebuilt in 1867 of a greyish limestone, and the constant dripping of water from the crevices has made deposits of rather dirty limey matter. In many cases regular stalactites have been formed, some reaching a length of a foot and a half, and being at least three-quarters of an inch in diameter at the base.

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Great Britain has recently been stirring in the matter of geographical teaching, and, though this country has benefited greatly by the work and presence of such men as Guyot and Maury, and by the continual progress of actual exploration, which has made certain aspects of geography familiar to the public mind, yet even here the teaching of this science leaves much to be desired, and it is not yet, we believe, recognized by a full professorship in any of our universities.

Astronomers at most observatories must envy those at Nice their clear skies. M. Charlois of that observatory was the first to pick up Tuttle's comet at its late return, and, although it was only possible to observe it for ten or fifteen minutes each morning, between the rising time and twilight, yet, in spite of its faintness, nearness to the horizon, and this limited time, he was able to compare its [illegible]

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THE ALERT EXPEDITION.

THE steamer Alert, Lieutenant Gordon, R. N., commanding, arrived at St. John's, N. F., Oct. 14, from her second attempt to reach Hudson Bay, having visited all the stations where observers had been placed in 1884, relieving the parties and supplying their places by fresh observers. All were well, only one death, that of a station hand by scurvy, having been reported. One of the stations was found deserted, but the party, fearing the Alert might not reach them, had taken passage on the Hudson Bay company's steamer Labrador. The results of work at the stations have been favorable, though exact details have not yet been received. The Alert reached her destination

without difficulty, and those most interested in the route by Hudson Bay to Europe for the wheat of Manitoba, are enthusiastic in their assertions that this proves the practicability of the route. A sober second thought, however, would indicate that, as far as yet made public, absolutely nothing new has been learned on the voyage of the Alert. The character of the navigation of Hudson Bay, a great shoal inlet, with its bottom dotted with stupendous bowlders often rising nearly to the surface; with no good port in the southwest, where, at the best anchorage, the vessel lies eight or nine miles from what must be the shipping point, permanent piers of any length being out of the question, owing to the movements of the ice; a strictly arctic climate, constant mirage, and no charts of any value: these incidents of the plan do not seem to be affected by anything done on the voyage as far as yet known.

USE AND ABUSE OF LEARNED SOCIETIES.

EVERY country thinks, doubtless, when it looks at the peculiar way in which things are done in other countries, that it could devise a method of much more dignity and wisdom for carrying out its purposes. We may certainly be excused for thinking that the plans by which great men are selected in both England and France might be improved upon. The familiar story of the candidate for the fortieth arm-chair of the French academy going about and soliciting the votes of thirty-nine immortals, never fails to give one an unpleasant shock at every fresh hearing. Even our presidential candidates are considered to be deficient in dignity when they make public speeches in their own behalf, and the literary man is supposed to be a man of much more delicate feeling than any politician. Nor is the English way of granting admission into the Royal society at all to be preferred; to hold an actual competitive examination, on the result of which a certain number of successful candidates are annually chosen, is not to show deference to the feelings of the candidate any more than the French have done.

There is a simple principle that should guide the bestowal of honors,—it is that they should be given and not sought. In private life a man is not expected to press his merits or his company upon his friends. We should consider it a barbarous social etiquette in which a person was required to call upon all his acquaintances and beg to be invited to their choicest dinners. If rewards are to be given at all for distinction in science or in letters, they should be given freely, and not be made bitter by conditions to which a gentleman has never before been obliged to submit. It may be a difficult matter to make the proper choice, but, at least, it should be made without the assistance of the candidate himself.

The English method has the additional disadvantage that it does not secure the men whom it is most desirable to honor. During the school-boy period, the distinction between different individuals is a distinction of learning, and an examination is not unfitted to discover the boy who deserves reward. But learning is not the quality which a state needs to make it great. Casaubons are not the kind of men who have built up English science. The qualities which ought to be encouraged, and which it should be a nation's delight to honor, are qualities too subtle to be detected by a competitive examination. That is a way of dealing out honors which, as Professor Chrystal has just said before the British association, belongs to the pupillary age both of men and of nations.

In our own national academy, whose tender age forbids as yet the lustre that clings to the ancient institutions of the European capitals, the only knowledge a man may have that he is a candidate for election is through the imprudence of his friends among the academicians,—an imprudence which is unhappily too common. Indeed it is becoming evident to many that the candidate active in pushing his own claims, in however secret a manner, is *pro tanto* lessening his chances of admission. And this is as it should be; merit in the eyes of others should be the single test.

THE RECENT EDUCATIONAL MEETING IN BOSTON.

THE educational conference, which met on Friday and Saturday, Oct. 16 and 17, at the Boston Latin school, was one of the most notable ever held in America, by reason of the representative character of the delegates, the nature of the topics discussed, and the possible effect upon our higher education of the movement there inaugurated.

The teachers of the preparatory schools have for some time been conscious of certain difficulties arising from the lack of a proper understanding on their part of what the colleges really desire of them, and particularly as regards the requisitions for admission to college, in the determination of which, they, however interested parties, have never been recognized as having a voice. Addi-

tional subjects have been added from time to time to the requirements, additional quantities also in the traditional subjects, while each college has more or less contributed to the diversity of the programme submitted to the preparatory schools.

Those unsatisfactory relations were the subject of a very frank discussion at the meeting of the Massachusetts classical and high school teachers association in 1884. Resolutions were passed setting forth the desirability of a meeting of delegates of that body with representatives of the New England colleges to consider matters of common interest, and at the following meeting, in April, 1885, a committee was appointed to make arrangements for such a conference.

The response of the colleges was most cordial, as may be inferred from the fact that fourteen colleges were represented at the recent meeting, and eleven of these by their presidents. Nearly every one of the leading academies which fit for college, as well as many of the public high schools of the larger New England cities and towns, were also represented by their principals.

The programme of the meeting involved the presentation of only four papers, with a discussion of each. Two of these were prepared by persons connected with colleges and two by preparatory teachers, and in each instance the discussion was opened by a delegate representing the alternate interest. From the side of the colleges, President Porter of Yale spoke on the question, 'How can the preparatory schools coöperate more effectively with the colleges?' and Professor Fay of Tufts college had prepared an answer to the query, 'What are some of the most prominent and prevailing defects in the preparation of candidates for college?' the material cited in evidence being collated from nine leading colleges. The questions, 'Is any greater degree of uniformity in the requisitions for admission to college practicable?' and, 'Under what conditions might admission to college by certificate be permitted?' were treated respectively by Principal Bancroft, of Phillips academy, Andover, and Dr. Robert P. Keep of the Free academy, Norwich, Conn., while the discussions on these topics were opened by President Eliot of Harvard and President Robinson of Brown university.

The papers were characterized by the completest frankness, and the evils which stand in the way of a consistent, consecutive, and honest national system of education, were unflinchingly faced. The representatives of the colleges were given a clear understanding of the practical difficulties they created for the fitting schools, while the teachers of those schools learned, perhaps for the first time, just how the products of their efforts are regarded by the college professors, into whose hands they are committed for a continuance of the work begun by them. The showing was anything but gratifying to our national vanity, for the fact was not overlooked that the colleges find it hardly possible to correct the careless or lazy intellectual habits contracted in the preparatory schools. On the other hand, the colleges were held responsible for the larger part of the evil, owing to the excessive burden put by them upon the schools. The traditional absurdity of setting quantity above quality in the requirements for admission to college was boldly criticised, and hopes were expressed that some plan, that will prove satisfactory to all parties, may yet be devised for admission of students upon the certificate of competent teachers that they are prepared to pursue a collegiate course with profit.

If any came to the meeting skeptical as to any practical results of a conference of two classes of teachers, whose work, however naturally a unit, has thus far been conducted in entire independence, the one part of the other, he must have been happily disappointed. When one considers the staleness of the subjects usually treated at educational meetings, the threshing of old straw, and the half-dreariness of the interest manifested in many cases by the leaders, the freshness and enthusiasm of the conference were something worthy of especial comment. While to the college men certain of the subjects were perhaps commonplace, they came with a degree of freshness to the teachers of the schools: and so, on the other hand, it was something quite new for the presidents and professors to hear clearly voiced the sentiments of the preparatory teachers, of which they had heard only vague echoes. Hence, when the programme of papers and discussions was ended, the conference, with an eager unanimity, resolved itself into a permanent organization, to be known as the 'New England association of colleges and preparatory schools.'

The first practical result of the conference was the passage of the following resolutions with regard to uniformity of requisitions:

First,—Resolved, That this conference of college presidents, principals and teachers in preparatory schools, earnestly appeals to the colleges for concerted action on their part in order to secure uniform requisitions in all subjects and authors in which they have a common requirement.

Second,—Resolved, That this conference urge upon the colleges a still closer agreement on their part as to the subjects to be set for examination, the recommendations to be made to the schools, and the nature and extent of the entrance examinations.

Third,—Resolved, That this conference request the colleges to make reasonable announcement of any [illegible] require[illegible]mission.

Fourth,—Resolved, That this conference request the colleges to unite in prescribing definitely the subjects which may be offered at the partial or preliminary examinations, the minimum number for which a certificate will be given, and to decide whether a final examination may be converted in any case into a preliminary examination, or a preliminary examination into a final examination, and if so, on what terms.

Fifth,—Resolved, That this conference urge upon the colleges coöperation and comity, either in accepting each other's certificates of examination, or in establishing jointly an examining board, whose duty it shall be to set papers, conduct examinations, and issue certificates on their behalf, which certificates shall be good in any college in the syndicate.

Naturally the public at large is not so directly interested in this particular subject of uniform requisitions as the preparatory teachers, but certain cognate topics of a general interest cannot fail to be considered in connection with this matter. First of all, and of the greatest importance in view of the very bad state of affairs shown by the paper upon prominent and prevailing defects in the preparation of candidates for college, the relative value of a thorough grounding in the elements of each of the subjects on which the candidate is required to be examined, as compared with the present superficial attempt to perform an excessive stint, cannot fail to be considered. Science cannot fail to derive a direct advantage from a change for the better in this particular. If, as it appears, inaccuracy and lack of intellectual independence are the striking defects noticeable among college students, any reform which shall tend to do away with such unscientific, as well as unscholarly deficiencies, will be of benefit in increasing the number of educated men from whom science has something to hope.

AN ADVANCE IN FISH CULTURE.

NOTWITHSTANDING the successes of fish culture in replenishing the depleted waters of our Pacific slope with quinnat salmon, those of the great lakes with white-fish, and the rivers of the east with shad, little has resulted from the efforts to restore Salmo salar to its native haunts in New England, or to acclimate it in the Hudson, the Susquehanna or the Potomac. The introduction of the quinnat salmon into Atlantic waters has as yet not been accomplished, and the attempts toward this end must be classed as experimental, rather than actual fish culture. In an infant art like fish culture, the only road to success is through scientific experimentation, and it is the freedom with which tentative work has been done by the U. S. fish commission, which has placed American fish culture so far in advance of that of the old world.

Experimental fish culture has frequently led to practical results in a manner not at all anticipated; never, however, more strikingly than in the recent salmon work in the basin of the Hudson. In 1883, through the coöperation of the U. S. commission with one of the commissioners of the state of New York, 40,000 fry of salmon were brought from the Penobscot and placed in Clendon Brook, near Glens Falls, N. Y. The brook was placarded and policed, and this fall it is found to be alive with young salmon throughout its entire length. There are numerous fish just ready to be transformed from 'parrs' into 'smolts;' these are about six inches long, and will, doubtless, soon go out to sea to return in about three years as adult salmon. There are also numerous smaller fish, representing the 60,000 fry which were planted in the same stream last April. The larger ones take the fly with great eagerness.

Heretofore, in planting salmon, it has been customary to place the little fish in the streams and allow them to care for themselves, but the new idea of placing them in protected preserves, where they can be cared for by the people living near at hand, and their growth to the proper size assured, will, no doubt, revolutionize salmon culture.

A similar experiment has lately been made at the station of the U. S. fish commission at Wytheville, Va., where 30,000 California trout have been confined until they have become vigorous fish of half a foot in length; they will be used, instead of helpless fry just freed from the yolk sac, in stocking the Atlantic slope with this fine species.

The conclusion of the Clendon Brook experiment will be eagerly looked for, not only by anglers and economists, but by zoölogists generally, to whom the extension of the actual habitat of a large river fish, some three degrees to the southward, will be a matter of considerable interest.

THE FLOOD ROCK EXPLOSION FELT AT HARVARD COLLEGE.

AT a meeting of the American academy of arts and science, held in Boston, Oct. 10, Prof. W. A. Rogers, of the Harvard college observatory, gave an account of his observations to detect any trembling of the earth at the time of the Flood Rock explosion. Professor Rogers stated that at 11:17:30 by the chronometer a very decided commotion of the surface of the mercury was observed. About 15 seconds later the rumble of an ice wagon was heard at a distance of 1,000 or 1,300 feet from the observatory. From this instant the effects of the disturbance by the wagon and of the explosion were combined, but the disturbance

[illegible] the [illegible] [illegible] [illegible]

in Hades, like two characters in Lucian, possibly talking about this very book of Caird's, and vainly trying, with the tolerance suitable to disembodied spirits, to find out each what the other might be in the universe to do. They would hardly succeed so well as in this book Prof. Caird has succeeded for them. He has seen their close spiritual relationship, and has shown how much Comte's aim was like Hegel's. If in doing this he has rather delighted in reducing Comte to Hegel, than in trying to read Hegel in terms of Comte, the injustice, if it be such, is one natural to a disciple's nature, and also a necessary result of the fact that he has applied his criticism mainly to Comte's social philosophy. An equally thoughtful and tolerant Comtian critic, coming from his side with corresponding motives to the study of Hegel's *naturphilosophie*, would probably find no great difficulty in reducing whatever is significant in this part of Hegel to the terminology and to the thought of Comte.

But Prof. Caird is surely right in taking these two great thinkers to be expressions, unconsciously analogous, of the same great tendency. They both summed up the age of the reaction. In the temperaments of both smouldered the same repressed romantic fire, which each of them scorned in others, and could not destroy in himself. In each this same natural and suppressed sympathy with the romantic movement gave color to his results; each struggled with his temperament, and in each this struggle became his system. For philosophical systems, like all other products of devoted lives, are the results of inner personal conflicts of character. Hegel and Comte differed as Swabian from Frenchman; but their problems were much the same, and their results profoundly similar, beneath all the great external differences. Hence the concrete psychological interest of a book like the present.

There is no space here to go into the details of Prof. Caird's discussion. The book begins by pointing out the main elements both in the scientific and in the social philosophy of Comte. This part of the work is on the whole done very appreciatively. Then, in chapter ii., Prof. Caird begins his criticisms. Yet these criticisms are never merely destructive. The deeper sense of the doctrine is sought, and Prof. Caird easily finds, sometimes perhaps too easily, that where Comte was true to himself and to his problems, he was true also to essentially Hegelian principles. That Comte, for instance, in his hatred for what he called 'metaphysics,' stood in fact unconsciously on Kantian, and so on the Hegelian ground, is clear. That when Comte, after seeming to be a pure nominalist in his war with traditional religion and metaphysics, turns about and says: "Man is a mere abstraction, and there is nothing real but humanity," he comes upon decidedly Hegelian ground. "The defect," says Prof. Caird, "lies in the unconsciousness of his own metaphysic."

As chapter ii. is devoted to the negative or destructive side of Comte's doctrine, chapter iii. discusses the 'positive or constructive side,' including, in this, Comte's 'substitutes for metaphysic and theology.' Toward the end of the book, in chapter iv., on 'Comte's view of the relation of the intellect to the heart,' Prof. Caird seems to us to take his task too easily, and to content himself too frequently with inspiring but decidedly dark sayings. But here, very possibly, our failure to follow may be a matter of our own weakness in Prof. Caird's faith.

Prof. Caird's result assimilates very closely Comte's position in philosophy to that of Kant, namely, in so far as his thought was unconsciously, a germ out of which a positive idealism would have to grow if it were developed. "Also partly because he lived at a later time, and in the midst of a society which was in the throes of a social revolution, and partly because of the keenness and strength of his own social sympathies, he gives us a kind of insight into the diseases and wants of modern society, which we could not expect from Kant, and which throws new light upon the ethical speculations of Kant's idealistic successors." One has to believe, thinks Prof. Caird, that his system is 'inconsistent with itself' and that his historical and social theories are defective. But one finds him well worthy of study.

Let us add that one does not need to be an Hegelian in order to appreciate the skill and tolerance of Prof. Caird's book, and to find much that is deeply interesting, not only from a philosophic, but also from a purely psychological point of view, in this suggestion of strong mental and moral likeness under an external show of great diversity. In this sense, Prof. Caird has made a most helpful contribution to what we much need,—a psychological history of thought as a product of social and individual temperament.

RUSSIA UNDER THE TZARS.

Readers of 'Underground Russia' are familiar with the great fortress of Peter and Paul, famous as the place from which Krapotkine made his memorable escape, and they will recognize it here —not as an old friend—but as an old enemy. Not content, however, with a horrible description of the cruelties perpetrated in this place under the

Russia under the tzars. By Stepniak. Rendered into English by Wm. Westall. New York, *Scribner's Sons*, 1885. 12°.

exercise of the Czar's government, our author has shown us the interior of the other prisons to which political prisoners are sent, and has added a sketch of the life led by the suspects in exile. This occupies the middle of the volume, which opens with an account of the constitutional development of Russia—if it can be called development, when nearly all the movement has been backwards—and it is followed by a dry though useful description of the educational system of the country, written with a view to show its utter inadequacy. Stepniak, whose recent articles in the London Times on the present state of the Russian army are full of interest, possesses a talent for describing scenes of suffering and woe, which would have made his or her fortune if turned into the profitable channel of sensational novel-writing. But this same faculty prejudices his reader against him as the truthful narrator of scenes in actual life, and one puts the book down with a feeling that, after all, the author has been trifling with his sympathies.

JOHNSON'S SURVEYING.

THE method of ascertaining distances and elevations by means of the engineer's transit instrument and stadia—where the apparent length on a staff intercepted by two parallel wires in a telescope gives the distance of the staff from the instrument, and the vertical angle serves to determine the elevation—has not, as yet, become well established in private surveying practice, although no one who is well informed in such matters doubts its applicability to a large range of geodetic work, its accuracy and convenience.

The use of the stadia has been confined almost altogether to the U. S. and state surveys. The experience which Professor Johnson, of Washington university, St. Louis, gained while engaged on the surveys of the great lakes and the Mississippi River, has enabled him to prepare a very clear and concise manual of the operations of topographical surveying as there practised. He also gives a detailed description of the work of measuring a base-line and triangulating when the survey is of moderate magnitude, indeed for any work except the most important, and he explains the projection of maps for large and small areas.

The book is well suited to the class-room and the field. We should have preferred, however, to find his discussion of utility and universal applicability of the method placed in the introduction instead of the body of the text, or gathered into a note, for, when the reader is once assured of its reliability, he will be likely to feel that a manual is needlessly encumbered with such arguments.

A manual of the theory and practice of topographical surveying by means of the transit and stadia; including secondary base-line and the triangulation measurements and the projection of maps. By J. B. JOHNSON, C. E. New York, *Wiley*, 1885.

NEW BOOKS.

**** For full titles see 'Publications received at editor's office.'*

'Aid to engineering solution' (Jackson) is intended to correspond with 'Aid to survey practice,' and to afford a succinct account of a simple general method of effecting engineering solutions, as well as to give a complete set of solutions useful to the engineer.——'Commercial organic analysis' (Allen) is the first volume of a revised edition, devoted chiefly to the consideration of bodies of the fatty series and of vegetable origin, and includes chapters on alcohols, ethers, and other neutral derivatives of the alcohols, sugars, starch and its isomers, and vegetable acids. The second volume is already on the press, and treats more especially of coal-tar products and bodies of the aromatic series, the fixed oils, and the products of their saponification; and the tannins will also be considered. It is proposed to devote a third volume to nitrogenized organic substances.——'Henfrey's English coins' (Keary) is a new edition of Henfrey's 'Guide to English coins,' with some corrections and enlargements, without any decided alterations in the form of the book.——'Silos for British fodder crops' (*The field*) is a third edition, the same as the last excepting that 48 pages have been appended to supply particulars respecting the ensilage competition of 1884.——'Mikroskopische reactionen' (Holtzendorff) is an attempt to bring together, for the use of chemists, reactions based on the crystalline form and optical qualities of substances, which can be used under the microscope.——'Spezial-karte von Africa' (Habenicht, Domann, and Lüddecke). This map, published by Justus Perthes in Gotha on the occasion of the centennial of the foundation of that house, is being made under the direction of Hermann Habenicht, Bruno Domann, and Dr. Richard Lüddecke. It will be published in ten parts on a scale of 1: 4,000,000.

GEOGRAPHICAL NOTES.

CHAFFAUJON writes from Ciudad-Bolivar of his recent journey to the upper Orinoco and Cauca rivers. He was accompanied by Indian guides, two from the Arigua tribe, an Arebato and a Guagnungomo, the latter belonging to a tribe feared for its valor and ferocity by all the people of the region. The party passed without difficulty as far as a little village near the Brazilian frontier, where

the Guagnungomo disappeared. This put the traveller on his guard, but, while rifling a burial place of the same tribe, he was suddenly attacked by a party of them, led by his former guide, who shot the Arebato fatally, but failed to wound Chaffaujon. The latter killed the renegade, whose companions disappeared, but carried or drove off all the animals and equipment of the party, as well as one of the Ariguas. With the other, however, the traveller escaped and reached the Cauca, which he descended on a raft to Tremblador, where the authorities had arrived with a military party in search of him. It would seem that it was his intention to return to Europe before long.

The U. S. revenue cutter Corwin arrived in San Francisco from the arctic, October 12. She brought with her the party sent out by General Miles last year to explore between the Copper and Yukon rivers. They were Lieut. H. F. Allen and Sergeants Robertson and Ficket of the Army signal office. They had crossed from the headwaters of the Atnah River to those of the Tananah, descended the latter to the Yukon, and the Yukon to the sea, accomplishing a most creditable journey, and one which a previous military party under Lieut. Abercrombie had failed to carry out. A considerable part of it was over an unexplored region. Messrs. Garland and Beatty, two English travellers who had crossed from the Mackenzie to the Yukon and descended the latter, were taken up with the American party at St. Michael's and brought to San Francisco. The Corwin also brought the crews of the Napoleon, the George and Susan, and the Mabel, three whalers lost this season in Bering Sea and the arctic. We have referred previously to the loss of the Napoleon; the two others appear to have been blown ashore in a gale, August 10, near Wainwright inlet, in latitude 70°. Three of the crew of the George and Susan were lost, but the catch of oil and bone was saved and brought down by the bark Ohio. The Corwin party themselves have accomplished some creditable exploring work during the season. Lieutenant Cantwell returned to his explorations of the Kowak River, while Asssistant engineer McLenegan, his companion in 1884 (*Science* No. 98, p. 551), undertook the exploration of the Nunatok, or Noatok, River, a stream falling into Hotham inlet, near and west from the Kowak, and so far less known than the latter. The Inland, or Noatok, River had been supposed to be a more important stream than the Kowak until the investigations of Cantwell and Stoney threw a doubt on the matter. Stoney's party, whose preparations for wintering we have already noticed, sent a mail down by the Corwin, which left them near the head of Hotham inlet. The explorations of the present year were entirely successful, and will be referred to again when details have been received.

Thoroddson contributes to *Globus* an account of his explorations in Iceland in 1884, which is more full and precise than the notes previously published. It appears that in a journey of ten weeks over the Odádahraun desert and the adjacent mountains, about one-half was passed in an uninhabited region, much of which was completely unknown. He forced his way along the northern base of Vatna Jokûll, the journey being frequently hazardous and always laborious. Many corrections of heights were made, and it seems that Jökulsa, which has been taken as the longest Icelandic river, is exceeded by Thiörsa, which is some 120 miles in length. An ascent of the unvisited and important Dyngja volcano was made. It proved to have a double crater, the inner one being 600 feet or more in depth.

The autumnal exodus of the fleet from Alaskan and arctic waters brings letters and successive mails with a profusion which contrasts strangely with the one opportunity of midsummer or the want of any opportunity from October to March, west of Mt. St. Elias. The sealing schooner San Diego, which has had a thrilling history in Alaskan waters and was thought to have foundered this fall in a severe gale, has reported in good order. The coast survey steamer Patterson, which has been surveying in Alaskan waters during the summer, has put in to San Francisco, having encountered heavy gales on the way down. The whalers are reporting, after an unusually successful season; the first to appear being the Coral with 1,600 bbls. of oil and 16,000 pounds of whalebone. She brought a slab of baleen from the Alaskan right whale, captured off Kadiak, and now very rare, which excited the astonishment of old whalers. It was only six feet long, but weighed nine hundred pounds, and is said to be the heaviest on record from the Pacific. According to advices from Kadiak, of Sept. 22, that flourishing village of St. Paul had not to that date seen or heard anything official of the existence of the supposed territorial government, instituted nearly two years ago. No revenue cutter had visited them for three years, although this is the port of third importance in the territory, with a good commerce and boasting a deputy collector of customs. The salmon canning had ceased for the season; owing to the low price of fish, but 60,000 cases of salmon and boneless codfish had been put up, with about 1,000 barrels of salt salmon and a certain amount of smoked halibut. Reports from the other fishing stations and the outlying trading posts had not been received, but the harvest of furs and sea-otter skins was an excellent one wherever heard

from. Wreckage of oriental origin, including part of a vessel's rail with a money box cut into it and containing some Chinese coins, had been picked up on the shore of Montague Island, Prince William Sound. The season at Kadiak had been a fine one, the crop of potatoes and especially of cauliflowers being very successful, but at Iliamna trading station, Cook's Inlet, a freshet occurred during the summer, by which the course of a small stream was changed and the trader's house actually washed away. A gale in July at Cold Bay, on the peninsula, caught a sea-otter party of Aleuts far from land in their kayaks, and for forty-eight hours they were obliged to use their paddles to keep from foundering. Five were drowned. The volcano of St. Augustin in Cook's Inlet continues to emit smoke and steam from many fissures. Water is still very scarce there, but several white otter hunters have established themselves upon the island for the winter. In southeastern Alaska the Treadwell or Paris mine is proving a great success The new mill, numbering 120 stamps, sent down $95,000 as the result of the first twenty-five days' work, and there is an almost unlimited quantity of low grade ore milling, net, about $5.00 to $8.00 gold per ton. This has stimulated work on the gold mines near Sitka, which are much richer but less extensive.

ASTRONOMICAL NOTES.

Meeting of the Astronomische gesellschaft.—*Nature* (xxxii., 516) gives a rather full account of the meeting of the Astronomische gesellschaft held at Geneva, August 19–22. Among about fifty members present we see the names of Struve, Newcomb, Christie, Auwers, Krueger, Tisserand, Weiss, and Schoenfeld. Reports were read on the present state of the computation of planetary orbits, on the zone work of the society, and on the photographic mapping of the stars of the Bonn *Durchmusterung* begun by Gill at the Cape. Professor Auwers read a paper by Professor Pickering on the photometric survey of the heavens, which was heard with especial interest; and Staatsrath Struve, in presenting photographs of the Pulkowa 30-inch refractor, expressed his complete satisfaction with the instrument. On the last day of the meeting addresses were made by Professor Gyldén on the graphic representation of planetary orbits, by Professor Newcomb on perturbations and their numerical calculation, and by Dr. Mueller on modern photographic apparatus. Other papers were read by Professors Bakhuyzen, Seeliger, Safařik and Weiss. The subject of most general immediate interest was the discussion of the sixth resolution of the Washington meridian conference, recommending a change in the beginning of the astronomical day. Struve, Folie and Pechüle seemed to be the only members in favor of the change, while Newcomb, Weiss, Krueger, Dunér, Auwers, Tietjen and Safařik, spoke in opposition to it. Professor Gyldén thought it inexpedient to make the change at present, though he was of the opinion that, in twenty or thirty years hence, the majority of astronomers would be in favor of a universal time. The statement by Struve that in the Royal astronomical society the majority are in favor of the universal time, has been corrected by Mr. Downing of the Greenwich observatory, who says (*Nature* xxxii., 353) that "the Royal astronomical society as a body has not expressed any opinion on the subject. And judging from the individual expressions of opinion which have been published, I should imagine that here, as at Geneva, the majority of real workers in our science (with the probable exception of those engaged on solar work) would be opposed to the proposed change." No resolution in regard to the matter was passed by the gesellschaft. The next meeting will be held at Kiel in 1887.

Displacement of solar lines.—In order to obtain, if possible, further evidence upon the disputed question as to whether the displacements and distortions of lines in solar spectra are due to actual drag of masses of gas to or from us, sometimes calling for velocities of 400 or 500km. per second, M. Trepied proposes, in the *Bulletin astronomique* for August, an arrangement of apparatus by which, after the light has passed through slit and collimator, the beam shall be divided so as to show two spectra superimposed at any desired point of either, thus allowing simultaneous optical examination, or micrometrical measurement, upon two lines from exactly the same part of the sun. He then proposes to test Fizeau's law that the ratio of displacement to wave-length, $\frac{\Delta\lambda}{\lambda}$, should be constant throughout the spectrum, for any one velocity of the luminous source to or from us. He will begin with the C and F lines of hydrogen, the ratio of whose wave-lengths is about 1.35 to 1.00. It would seem as if this difference should show plainly in the relative displacements, but it must be remembered that the largest of these take the form of very irregular distortions of the lines, and the different brightness and color of the lines and their background may perhaps differently affect their visible or measurable limits. His results will be awaited with interest.

Parallax of 40 o^2 Eridani.—Professor Hall publishes, in No. 2682 of the *Astronomische nachrichten*, the results of observations made in 1883 and 1884

to determine the annual parallax of the star 40 o^2 Eridani. The principal star of this system has a proper motion of 4″ a year; and, at a distance of 82″, there is a double companion, which has the same proper motion, while nearly between them is a small star which does not move. Professor Hall finds for the parallax of 40 Eridani

$$\pi = 0''.223 \pm 0''.0208.$$

a result rather smaller than might have been expected, but one which he considers worthy of considerable confidence.

Comet Tuttle (1790 II.).—Swift reports having found the comet on August 13. He describes it as "fairly bright on a dark sky, and shows a strong condensation at the centre." As far as we have learned, he is the only one who has seen the comet at this return, except the astronomers at Nice.

The nebula in Andromeda.—The new star in the Andromeda nebula continues to decrease in brightness. On October 10 it was estimated as 9.9 magnitude with the transit circle of the U. S. naval observatory. This estimate depends upon the same star used in the previous observations (*Science* vi., 310).

Comet 1881 III (*b*) Tebbutt.—Dr. de Ball intends to compute the orbit of the above comet, and calls for any observations still unpublished. Address, 'Dr. de Ball, Observatoire, Ougrée, Liége, Belgium.'

NOTES AND NEWS.

The curriculum of the University of Michigan has been altered and enlarged in order to provide a specific course of study for students who wish to devote their time largely to biological work, either as a preparation for the study of medicine or with a view to teaching or engaging in biological research. Zoölogy, botany, and physiology are the most prominent subjects of the course, but full opportunity is given for extended work in physics, chemistry, paleontology, and other sciences.

— The first one of a course of ten lectures on physiology and hygiene, under the auspices of the Cincinnati society of natural history, was given on October 3. These lectures are free to teachers of the public schools, and the interest is shown by the application of about seventy-five teachers for tickets to the course. This is the second course given by the society, the first having been on botany.

— Cable dispatches announce the death of Thomas Davidson, preëminently the British student of Brachiopoda. He was born in Edinburgh, May 17, 1817, and received most of his education on the continent. A review of his latest work will be found in *Science* (v., 409). The monograph of recent Brachiopoda, there referred to as in preparation, has actually been completed. Under date of June 1, in a letter to a friend in this country, which we have been permitted to see, he says that it will be accompanied by 30 plates, containing 865 figures, and adds: "I can assure you that this work has taken me a long time to complete, and, since I have been ill for several months, it is fortunate that all is ready to send to the printer. I have thus been able to bring to successful conclusion all that I had proposed to accomplish, and I am now ready to leave this world as soon as God wills." This indefatigable investigator adds that he has also completed a bibliography of the Brachiopoda which will occupy about 200 quarto pages and contain about 3400 titles; the first part will be printed by the Palæontographical society this year and the balance in the volume for 1886. "I have been able," he concludes, "to make a very rich and nearly complete collection of recent Brachiopoda, and I propose to bequeath the whole of this, as well as all my fossils, to the British museum."

— James Macfarlane, well-known for his useful 'Geological railway guide' and 'Geologist's travelling handbook,' died suddenly on the 12th instant at his home in Towanda, Penn., of heart disease. He was born Sept. 2, 1819, at Gettysburg, Penn.

— In the *Philosophical magazine* for August, Shelford Bidwell, Esq., in a paper entitled 'The sensitiveness of selenium to light and the development of a similar property in sulphur,' describes a series of very interesting experiments, which would seem to show that the action of light in varying the resistance of a selenium cell arises from the fact that the conductivity of the cell is due to a selenide of the metal with which it is annealed (the crystalline selenium itself being practically a non-conductor), and that the formation of this selenide is assisted by direct radiation of light. With sulphur and silver he formed cells showing the same variation of resistance in light and darkness, and showed very plainly that the union of sulphur and silver into the sulphide, at ordinary temperatures, is greatly assisted by direct radiation, and is not due to rise of temperature of the substances themselves. The whole analogy of the actions of sulphur and selenium in the two cases, coupled with the enormously high resistance of pure selenium when crystallized between glass plates or substances with which it does not combine, seem to render his conclusions highly probable. The whole paper is of great interest.

— The Russian government has just despatched one of the foremost mining authorities of the day, M. Gulishambaroff, to Askabad, in Central Asia,

history of the United States' were drawn from nature on stone by Sonrel.

WASHINGTON LETTER.

The Chemical society, although one of the youngest, is by no means the least active of the scientific societies of Washington; in fact it will take a relatively high rank in that respect. It is presided over by Professor F. W. Clarke and its members number about forty. The first meeting for the season was held on the evening of the 8th of October. It happened that both the president and secretary were absent, but there was a good attendance of members and an interesting meeting was held. Mr. Chatard gave an informal account of his recent examination of the leading salt works of the country, together with a general discussion of the manufacture of salt in America. Mr. Chatard has been engaged for some time under the U. S. geological survey in the study of this question, especially with a view of determining whether any practical use can be made of the great alkali deposits which are so abundant in the United States, and it is likely that the subject will occupy his attention for some time to come.

It has sometimes been found difficult to provide interesting material for the 'first meetings' of societies here, for the reason that many of the active contributors to their proceedings have just returned from their summer campaigns and have had no leisure for working up the material which they have accumulated. The Chemical society was this year an exception to the rule and so, also, was the Philosophical society, which held its first meeting on the evening of Saturday, the 10th of October. Dr. Billings had provided an interesting programme in the exhibition and discussion of a large and valuable collection of anthropometric apparatus recently received at the Army and navy medical museum. A large part of it was a duplicate of what had been used by Galton in his laboratory, and a very interesting part had been manufactured in Germany by Mr. Cattell. It was understood that the latter involved some improvements on forms devised by Mr. Stanley Hall for the investigation of the time occupied in certain simple mental processes. By means of a sort of drop shutter, somewhat resembling a guillotine, the subject upon whom the experiment was being made was permitted to see for only an instant the object, the nature of which he was to determine as quickly as possible. The thing to be seen may be a card of a particular color, the subject being required to decide what color it is, or but two colors may be used and he may be required to decide which of the two appears. Diagrams of different forms may be used, and the time occupied in judgment of form determined. Cards with various numbers of well defined dots on them may also be displayed, and the subject required to announce the number as determined from his instantaneous view of the card. In this way something may be known in regard to the maximum number of individual objects which one recognizes, or can correctly announce, without the operation of counting. It was stated that experiments conducted in this manner gave three as this maximum, which is certainly less than the result obtained by a different mode of experimentation. The apparatus was arranged to register the time intervals by means of a Hipp's chronoscope. Considerable discussion resulted from the exhibition of the instruments, and the use of a Hipp's chronoscope was criticised by several members. It is unquestionably complicated in its form and requires a good deal of skill and experience in its use. There are several modern methods of time measurement for small intervals which appear to excel it in simplicity of construction, ease of operation, and accuracy of performance. So much interest was manifested in this discussion that it was found necessary to postpone a paper on psychrometry by Mr. H. A. Hazen, which was on the programme for the evening, and it will be taken up at the next meeting.

Lieut. Cornwall of the Bureau of navigation, in charge of the 'division of compasses,' has gone to Mr. Roach's ship-yard at Chester, Penn., to make experiments on the magnetic constants of the new steel cruisers, Boston, Atlanta, and Chicago. The last is still unfinished and as its azimuth has been constant for some months, the investigation of its magnetism now, and again after launching, will doubtless be of much interest.

Within the past week the capital has been visited by Mr. Clements R. Markham, secretary of the Royal geographical society of London. His stay in the city was necessarily short, and he was unable to visit all of the centres of scientific activity in the city; but his brief visit was much enjoyed by those who had the pleasure of making his acquaintance.

Not everybody is aware of the interest which Professor A. Graham Bell has long taken in the instruction of deaf-mutes, or that he has for some time maintained an 'experimental' school for deaf children in this city. Mr. Bell has recently taken a very important step in the organization of a normal or training school for teachers in connection with this school for children. He is desirous of training young ladies who are thoroughly interested in this work, in the methods which he has devised, tested, and approved for instructing deaf-mutes, and especially in the methods of teaching

articulation, upon which subject Mr. Bell has bestowed a vast deal of time and study. But a limited number of teachers in training can be accommodated, and the opportunity is doubtless one which will be eagerly sought.

The national museum, Mr. Barnum, and the big elephant Jumbo, have all received a good deal of public notice arising from the singular death of the gigantic and lamented beast. The public was at first assured that the bones of this creature, fated to disturb two continents, were to rest in the national depository, although it was stated that the stuffed skin was to adorn the collection of a New England college. Recent information, however, seems to indicate that Mr. Barnum has awakened to the fact that he now has two Jumbos, instead of one, and that both may continue to be sources of profit for some time to come as parts of one or two travelling 'aggregations.' There is little doubt but that a year or two of this sort of an existence would greatly diminish the value of the skeleton of the elephant, and it is stated that the director of the national museum is in correspondence with Mr. Barnum with a view to prevent such a calamity, in which effort everybody wishes him success. Reference was made in the letter of two weeks ago to the large acquisitions of the museum through the New Orleans exposition. The curators of the various departments are getting some of these collections into shape, and although they are in some instances embarrassed by lack of space, some effective displays will be made. A very valuable, and, in some respects, typical collection was presented by the Japanese government, and has just been unpacked. It is intended to present an epitome of the arts and industries of the country, and as such it will doubtless be kept together for some time, and conspicuously displayed. It includes illustrations of the handicraft of the ingenious natives of Japan in pottery, porcelain, lacquer, bronze, silver, and copper, and also models and water-color sketches illustrating Japanese fisheries, domestic occupations and the like. Z.

Washington, D. C., Oct. 19.

LETTERS TO THE EDITOR.

**** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

An attempt to photograph the corona.

Mr. W. H. Pickering having courteously sent me a copy of *Science* (August 14), containing an article entitled 'An attempt to photograph the solar corona without an eclipse,' may I ask you to insert the few lines which follow in the next number of your journal?

Passing by all those points which are covered, directly or indirectly, by my reply to Mr Pickering's first letter (*Science*, April 8), I find only two matters which I consider it necessary to notice.

1. Mr. Pickering says: "The inferiority of the best gelatine plates to the human eye in this respect [small differences of light] is very readily shown by an attempt to photograph distant mountains." He then goes on to say: "Another illustration of the same thing is the impossibility of photographing the moon in the daytime, when the sun is high above the horizon. Although the moon may be perfectly distinct to the eye, the negative shows no trace of it."

To your scientific readers, the reasons will readily suggest themselves, why, in the case of the moon in the daytime at some angular distance from the sun, the eye has an advantage over the plate, while, in the case of the corona, the plate has a great advantage over the eye. Apart from any such considerations, as a matter of fact, *there is no difficulty in photographing the moon at noonday.* Yesterday I took, with the apparatus used on the corona, four negatives on bromide plates (Edward's), between 11 30 A.M. and noon, in full sunshine. On all the plates, the moon is very distinct and well defined. The moon at noonday, unless too near the sun, is an easier object to photograph than the corona. It is obvious, therefore, that photographic methods, which are not delicate enough for the moon, must utterly fail if applied to an object still more difficult, as the corona undoubtedly is at ordinary elevations.

If Mr. Pickering's statement of the 'impossibility' of photographing the moon under the conditions already named, rests upon his own experiments, some light may come upon a point which has occasioned me surprise, namely, that Mr. Pickering does not appear to get upon his plates the defects of his own apparatus; for example, those of the position of his shutter and those of his spectacle lens. In some experiments I made with a shutter similarly placed, very strong diffraction effects appeared on the plates, effects stronger than any photographic action which could be supposed to be due to the corona.

2. With regard to Mr. Pickering's experiments, I would point out that the conclusion to which they lead him, namely, "It therefore seems that even in the clearest weather the reflected light of the atmosphere is 300 times too strong to obtain the faintest visible image of the true coronal rays," appears to me to be irreconcilable with the direct observations of Professor Langley and others of the planets Mercury and Venus, as black disks before they reach the sun. Professor Young says: "Of course this implies behind the planet a background (of corona) of *sensible* brightness in comparison with the illumination of our atmosphere." (The sun, p. 229.)

The Bakerian lecture read recently before the Royal society, in which I have discussed some of these points more fully, will be in print in a few weeks. The photographic method is now being tried at the Cape of Good Hope, under the scientific conditions I have pointed out as essential, by Mr. Ray Woods, under the able superintendence of Dr. Gill, F.R.S.

William Huggins.

From the above interesting communication by Dr. Huggins I regret to find that he has failed to see my reply published in *Science*, for April 29, to his letter of April 13. My experiments on the position of the drop-shutter were there taken up with some detail. Also other points presumably referred to in the beginning of his article are discussed.

As to the observations of the planets Mercury and Venus, as black disks before they reach the sun; the

explanation usually given [1] of this phenomenon is that it is due to the refraction of the sun's rays passing through their atmospheres, and thus illuminating rather more than one hemisphere at a time. Any small body surrounded by a ring of light would naturally appear darker by contrast than the surrounding background.

In regard to photographing the moon in the daytime, it may be as well to call attention first to the fact, that as the moon and sky are nearly of the same brilliancy, and there are accordingly no irradiation effects, it is not a question of the best form of apparatus, but almost entirely of the contrast qualities of the plate and developer employed. In fact an ordinary camera furnished with a long focussed landscape lens is as good an instrument as can be devised for this investigation. Fortunately I had on hand some of Edwards's bromide plates, imported last June, and they, together with some Carbutt B. and Anthony chloride plates, were employed in the following determinations.

It should also be stated in regard to my remark, reading "the impossibility of photographing the moon in the daytime, when the sun is high above the horizon," that this was merely a general statement, founded on observations made in June and July when the sun's altitude in the middle of the day was between 60° and 70°.

Dr. Huggins has now shown that this statement is not rigidly exact, as with the sun at an altitude of 35°, and the moon in the most favorable position at this season (the third quarter), he has obtained a distinct image upon his plates. I repeated his experiment, October 16 and 17, when the moon was in the first quarter, and with the sun at an altitude of 18° obtained a similar result. The images, though distinct, were far too faint to print, and only two plates out of nine showed any image at all, although the moon was very conspicuous to the eye. I should consider it doubtful if photographs of the moon could be obtained with the sun at an altitude of over 60°. If then there is difficulty in obtaining an impression of the moon at 90° distance from the sun, how much more difficult would it be to photograph the still fainter coronal rays, when masked by the dazzling brilliancy of our atmosphere in the sun's immediate neighborhood.

But what particularly interested me in Dr. Huggins's communication was, that I saw at once that it furnished me a new constant, and accordingly a new method, for determining the relative light of the atmosphere near the sun, and the corona. Five separate measurements were made between 1.15 and 4.15 on October 16 and 17, of the relative light of the sky in the immediate vicinity of the sun and moon, by the photographic method described in a previous paper.[2] These ratios varied from 16, when the sun was highest, to 50 at the later hour. Taking the average of these values, we may safely assume that between three and four o'clock, when my successful pictures of the moon were taken, the light about the sun is generally not far from 35 times as bright as the light of the sky in a region where it is just possible to photograph the moon. But according to the observation of Prof. S. P. Langley, previously quoted, the light of the moon is ten times that of the corona at 3′ distance from the sun. Accordingly the light of the atmosphere in the immediate vicinity of the sun would have to be reduced 350 times in order to obtain an impression of the corona upon our plates. If the sun were at a greater altitude, this figure would be somewhat smaller. The value found by my previous experiments was 320. The closeness of the coincidence is probably accidental, but of the two methods the first one seems to me rather the more accurate.

[1] Newcomb's Astronomy, p. 299. [2] *Science*, Aug. 14.

Wm. H. Pickering.

Voss-Holtz electrical machine.

In response to Mr. Eaton's communication in *Science*, No. 141, I would say that, about a year ago, I compiled for one of my classes a discussion of the Voss-Holtz electrical machine. Some months afterward Mr. E. B. Benjamin prepared a pamphlet regarding his machines, and asked my permission to incorporate what I had given my students regarding the theory of these. I granted his request, though not satisfied with the completeness of the discussion. What I had written had not been intended as a contribution to science, and I did not deem it of sufficient importance to quote authorities. Before putting my compilation on paper, I had consulted Ferguson, Silvanus Thompson, Ganot, Deschanel, some articles by Dr. Atkinson of Chicago, and the article in *Science* by Mr. H. W. Eaton. I cheerfully express my obligation to all of these writers. Mr. Eaton's article was specially helpful. As I claimed no originality, there was no attempt or wish to deprive him of any credit due.

The greater part of Mr. Benjamin's pamphlet was written by himself. W. Le C. Stevens.

Brooklyn, Oct. 19.

Recent Proceedings of Societies.

Academy of natural sciences, Philadelphia.

Botanical section, Oct. 12.—Mr. Aubrey H. Smith described the flowering of Gordonia pubescens in Bartram's garden and gave a history of the species.—Mr. John Redfield spoke of the topographical features of Martha's vineyard and Nantucket, in connection with the flora of those islands. The northern part of the former rises into rounded gravelly hills of considerable elevation, composed of gravel drift, with occasional large bowlders. They are evidently of glacial origin. The more central portion consists of level plains of gravel covered with oak, mostly Quercus obtusiloba. The general character of the flora is much like that found on the summit of the divides in southern New Jersey, though much more limited as to species. Farther south, extensive ponds both of fresh and salt water introduce their characteristic vegetation. In Nantucket he had found the gravelly hills of much less height, the greater portion of the island consisting, in fact, of treeless plains. One extensive grove of Pinus rigida exists in the central portion, and is known to have been planted. The most characteristic plants of the plains seemed to be bear-berry, Arctostaphylos uva-ursi, which grows there in great profusion. The two species of Hudsonia abound, the Hericoides being seen everywhere, and less frequently the bluish tufts of H. tomentosa. Polygalae polygama, Myrica, cerifera, and various vaccinæ abound. He saw many large patches of Corema Conradii, the existence of which in Nantucket had first been made known by Mrs. Owen of Springfield, Mass. But the most inter-

esting feature of the Nantucket flora is the existence of three species of heath under circumstances that lead to the belief that they are indigenous. Mr. Redfield has not seen the locality of Colluna vulgaris, but had seen that of Erica cinerea. The latter has been known and watched for ten or twelve years and is evidently long established. It grows in the open common, far away from the town, and there is nothing about its surroundings to indicate human introduction. It covers only a space of eight inches by ten. Since Mr. Redfield's visit he had learned that another and possibly a third locality of heath had been discovered widely distant from the first, and that in one case the species proved to be Erica tetralix. He held that the discovery of so many species, and these the same as are found associated in England, pointed strongly to an indigenous origin. Mr. Meehan in continuation described the associated growth of the three species of heath on the Isle of Wight.

Calendar of Societies.

Philosophical society, Washington.

Oct. 10.—Drs. J. S. Billings and Washington Matthews, Exhibition of anthropometric and reaction time apparatus.

Society of arts, Boston.

Oct. 22.—Mr. W. W. Jacques, Recent progress in underground wires.

Boston society of natural history.

Oct. 21.—Dr. S. Kneeland, Two memorial gravestones of the iron age, from central Sweden, bearing Runic inscriptions and other symbols.

Natural history society, Agricultural college, Mich.

October meeting.—Election of officers: G. W. Park, president; F. C. Davis, vice-president; H. L. Chapin, secretary; L. G. Carpenter, treasurer; W. H. Clemons, curator. Chairmen of sections: Agriculture, Prof. S. Johnson; astronomy, L. G. Carpenter; botany, Dr. W. J. Beal; chemistry, F. S. Kedzie; scientific method, Prof. L. McLouth; zoölogy, Prof. A. J. Cook.

Oct. 11.—J. B. Cotton, Parasites of Pieris rapae; W. G. Everhart, Contents of a drop of water; W. K. Clute, Unconscious bias in walking; A. B. Sudworth, A talk about mosses.

Publications received at Editor's Office, Oct. 12-17.

Balling, C. A. M. Die metalhüttenkunde. Berlin, *Springer*, 1885. 22+627 p., illustr. 8°. (New York, Stechert, $5.70)

Barus, C. and **Strouhal**, V. The electrical and magnetic properties of the iron-carburets. Washington, *Government*, 1885. (Bull. U. S. geol. surv. 14.) 238 p., illustr. 8°.

Beckert, T. Leitfaden zur eisenhüttenkunde. Berlin, *Springer*, 1885. 8+416 p., 3 pl., illustr. 8°. (New York, Stechert, $3.30.)

Benoit, M. J. R. Construction des étalons prototypes de résistance électrique du ministère de postes et des télégraphes. Paris, *Gauthier-Villars*, 1885. 80 p. 4°. (New York, Christern, $1.50.)

Bichat, M. E. et **Blondlot**, M. R. Instruction á l'étude de l'électricité statique. Paris, *Gauthier-Villars*, 1885. 10+141 p., illustr. 8°. (New York, Christern, $1.35.)

Bohn, C. Die landmessung. Heft 1. Berlin, *Springer*, 1886 (1885). 436 p., illustr. 8°. (New York, Stechert, $4.40.)

Brongniart, C. Les insectes fossiles des terrains primaires. Rouen, *impr. Lecerf*, 1885. [24 p.], 5 pl. 8°.

Chevallier, A.-F. et **Muentz**, A. Problèmes de physique avec leurs solutions développées. 2d ed. Paris, *Gauthier-Villars*, 1885. 8+205 p., illustr. 8° (New York, Christern, $2.)

Congres géologique international, 3ième session, Berlin, 1885. Membres présents. Berlin, *Sittenfeld, pr.*, 1885. 9 p. 8°.

Curtius, G. Zur kritik der neuesten sprachforschung. Leipzig, *Hirzel*, 1885. 161 p. 8°. (New York, Stechert, $1.)

Delbrueck, B. Die neueste sprachforschung. Betrachtungen über Georg Curtius shrift zur kritik der neuesten sprachforschung. Leipzig, *Breitkopf & Härtel*, 1885. 49 p. 8°. (New York, Stechert, 40 cents.)

Doolittle, C. L. A treatise on practical astronomy, as applied to geodesy and navigation. New York, *Wiley*, 1885. 10+641 p., illustr. 8°. $4.

Faye, H. Sur l'origine du monde. Théories cosmogoniques des anciens et des modernes. 2d ed. *Gauthier-Villars*, 1885. 12+309 p., illustr. 8°. (New York, Christern, $2.)

Forel, F. A. La formule des seiches. Geneve, *Arch. sc. phys. nat.*, 1885. 12 p. 8°.

Gieseler, E. A. On tidal theory and tidal predictions. Philadelphia, *Frankl. inst.*, 1885. 61 p. 8°.

Gretschel, H. and **Bornemann**, G. Jahrbuch der erfindungen. Leipzig, *Quandt & Handel*, 1885. 6+405 p., illustr. 12°. (New York, Stechert, $2.20.)

Halsted, G. B. The elements of geometry. New York, *Wiley*, 1885. 16+366 p., illustr. 8°. $1.75.

Hermite, M. C. Sur quelques applications des fonctions elliptiques. Fasc. i. Paris, *Gauthier-Villars*, 1885. 146 p. 4°. (New York, Christern, $2.50.)

Holder, C. F. Marvels of animal life. New York, *Scribner's Sons*, 1885. 10+240 p., illustr. 8°. $2.

Homan, G. *ed.* A sanitary survey of St. Louis, being a series of short papers on leading public health topics contributed by city officials and local sanitarians. Concord, N. H., *Repub. pr. ass.*, 1885. 77 p., 3 maps. 8°.

Huyghens. Traité de la lumière. Edited by W Burchhardt. Lipsiae, *Gressner & Schramm*. 4+134 p., illustr. 8°. (New York, Stechert, $2.20)

Jordan, W. Grundzüge der astronomischen zeit- und ortbestimmung. Berlin, *Springer*, 1885. 8+364+26 p., illustr. 8°. (New York, Stechert, $3.70.)

Justus Perthes in Gotha, 1785-1885. [Gotha, 1885.] 108 p., portr. 4°.

Karlowa, O. Römische rechtsgeschichte. Band i.: Staatsrecht und rechtsquellen. Leipzig, *Von Veit*, 1885. 8+1031 p. 8°. (New York, Christern, $9.55.)

Krenkel, M. Klassische bühnendichtungen der Spanier. II. Calderon, Der wundertätige zauberer. Leipzig, *Barth*, 1885. 20+349 p. 8°. (New York, Stechert, $2.)

Laughlin, J. L. The study of political economy. New York, *Appleton*, 1885. 153 p. 12°.

Le Conte, L. J. Are not dynamite catastrophes intimately associated with electric phenomena? (*Tech. soc. Pacif. coast.*) 1885. 8°.

Leray, Le P. A. Essai sur la synthèse des forces physiques. Paris, *Gauthier-Villars*, 1885. 10+180 p., illustr. 8°. (New York, Christern, $1.65.)

Lipsius, R. A. Philosophie und religion. Neue beiträge zur wissenschaftlichen grundlegung der dogmatik. Leipzig, *Barth*, 1885. 319 p. 8°. (New York, Stechert, $1.90.)

Mascart, E. und **Joubert**, J. Lehrbuch der elektricität und des magnetismus. Autorisirte deutsche übersetzung von Dr. L. Levy. Band i. Berlin, *Springer*, 1886 (1885). 20+592 p., illustr. 8°. (New York, Stechert, $5 20.)

Meyer, A. M. On a method of precisely measuring the vibratory periods of tuning forks, and the determinations of the laws of the vibrations of forks; with special reference of these facts and laws to the action of a simple chronoscope. (*Mem. Nat. acad. sc.* 3) 17 p., 4 pl. 4°.

Moore, E. H., jr. Extensions of certain theorems of Clifford and of Cayley in the geometry of *n* dimensions. New Haven, Conn., *Acad. sc.*, 1885. 18 p. 8°.

Newbery, J. C. The examination of waters. Melbourne, *Mason, Firth & M'Cutcheon, pr.*, 1885. 9 p. 16°.

Normand, J. A. Etude sur les torpilleurs. Paris, *Gauthier-Villars*, 1885. 88 p. 4°. (New York, Christern, 70 cents.)

Packard, A. S. On the structure of the brain of the sessile eyed Crustacea. (*Mem. Nat. acad. sc.* 3.) 14 p., 5 pl. 4°.

Scudder, S. H. Descriptions of an articulate of doubtful relationship from the tertiary beds of Florissant, Col. (*Mem. Nat. acad. sc.* 3.) 6 p. 4°.

Van Rysselberghe, M. F. Téléphonie et télégraphie simultanées. Précédé de notions préliminaires sur l'induction électrique, le téléphone et le microphone par E. Buels. Bruxelles, *Hayez, pr.*, 1885. 12+226 p., 7 pl. 12°. (New York, Christern, $1.65.)

Weygoldt, G. P. Die Platonische philosophie nach ihrem wesen und ihren schicksalen für höhergebildete aller stände. Leipzig, *Schulze*, 1885. 6+256 p. 12°. (New York, Stechert, $1.10.)

Wuelker, R. Grundriss zur geschichte der Angelsächsischen litteratur, mit einer übersicht der Angelsächsischen sprachwissenschaft. Leipzig, *Von Veit*, 1885. 12+532 p. 8°. (New York, Christern, $3 70.)

SCIENCE.—SUPPLEMENT.

FRIDAY, OCTOBER 23, 1885.

PRICES FROM 1873 TO 1884.

In the annual report issued by the mint department on the production of precious metals in 1884, there are given statistics of prices during the years 1883 and 1884. These statistics are in continuation of others of the same kind in previous reports. The figures for the years from 1825 to 1880 may be found in the quarterly report of the Bureau of statistics, No. 3, 1883–84; those for the years 1881 and 1882 in the report of the director of the mint for 1883; those for 1883 and 1884 in the present report. All of them, we are informed, were collected and arranged under the superintendence of Mr. Burchard, the former director of the mint, to whom belongs the credit for the work. The investigation is one which does not lie very obviously within the scope of the mint department, and recognition is due to the intelligence and activity which caused it to be undertaken.

The different reports, taken together, purport to give a continuous account of the fluctuations of general prices from 1825 to the present time. Such an account, if accurate and trustworthy, would be of great interest and value. Unfortunately the statistics have not been got together in a very careful way; and the general results which are deduced from them can be accepted only with liberal allowance for possible errors.

To the method adopted there can be little objection. It was to take the wholesale prices of a number of articles in New York, to reduce them to a common denominator, and then to calculate the arithmetical mean of the prices as reduced.

It can be easily illustrated by an example. Suppose that for three years the prices of cotton, wheat, and pig-iron, were as follows:

	1880.	1881.	1882.
Cotton	.10	.12	.08
Wheat	1.00	.80	1.50
Iron	20.00	30.00	40.00

Indicate the price of each article for the first year by 100, express the prices for the following years in percentages on that basis, and calculate the averages. The result is:

	1880.	1881.	1882.
Cotton	100	120	80
Wheat	100	80	150
Iron	100	150	200
Average.	100	116⅔	150

The average, or arithmetical mean, of the percentages here indicates a rise in prices over the average of 1880, of 16⅔ per cent in 1881, and of 50 per cent in 1882.

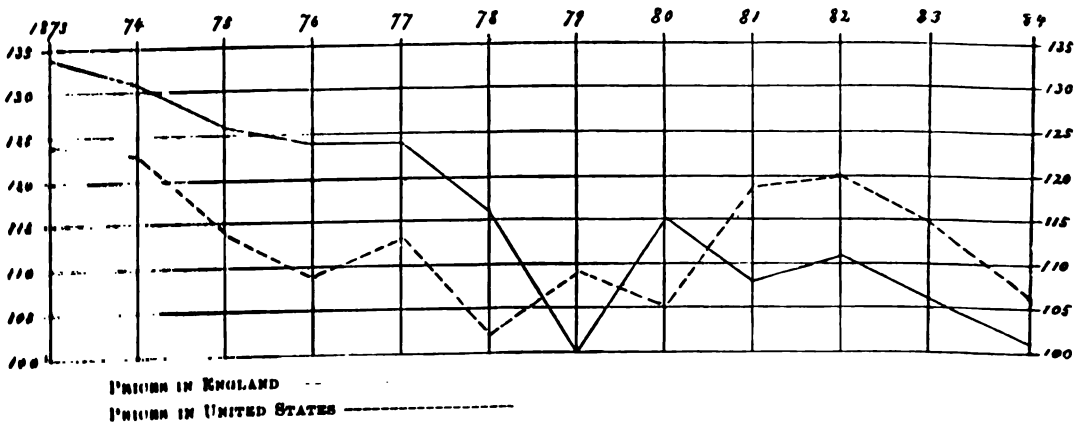
If the prices of a sufficiently large number of articles be taken, the averaged percentages indicate with sufficient accuracy the general rise or fall of prices. This is the method adopted in the mint reports; and it is also adopted in the *London economist's* annual table of prices. If applied with care, it is probably the safest way of calculating the rise and fall of general prices. Objections to it have been much urged, and other methods of calculation have been suggested and tried; but the various experiments seem to show pretty clearly that the simple arithmetical mean of the prices of a large number of articles gives as good an indication of the general fluctuations as we can hope to get.

Unfortunately the method has been applied with too little care and discrimination in the tables before us. In the first place, one cannot be sure that the prices quoted are the real market prices. For the years previous to 1873, they are taken bodily from two Treasury reports, those for 1863 and for 1873, in which tables of prices for a long series of years were brought together. There has always been a suspicion that these prices were largely made up by the clerks in the Treasury office, and that they were not worth much as a record of the real fluctuations. For the years after 1873, the figures were gathered specially for these mint reports, and may be more trustworthy. But even here there are obvious mistakes and inconsistencies. For instance, instead of taking the same articles consistently year by year, and deducing the average prices of these, the list changes almost every year. Thus for 1881 and 1882, the prices of 88 articles are given; in this year's report, however, for 1883 and 1884, those of 94 articles are taken. In other words, it is as if the prices of one set of articles for this year were compared with the prices of another set of articles for next year; a method which obviously, so far as the two sets vary, vitiates any comparison between them. It is part of the same error in these tables, that an article, after having been quoted and reckoned for a few years, suddenly disappears entirely, while another one perhaps takes its place, and is reckoned in the general average. One is therefore not surprised to find the results to be on their face inconsistent with each other. Thus the average

prices of 1884 are given as 92.2 per cent of those of 1883; yet side by side other figures are given which make the ratio 91 per cent.

Nevertheless, it would be going too far to say that the results are quite without value. A very large number of articles are included in the comparison, which gives a probability that the mistakes will balance each other, or will not appreciably affect the general results. It is not unreasonable to believe that the figures which are finally given as indicating the rise and fall of general prices for the successive years, although they cannot be accepted as an accurate gauge of the ascertainable change from any one year to the next year, yet represent fairly enough the general fluctuations of the series of years. They are at all events probably as good an index of the actual changes as the tables of the *London economist*, which have been much quoted and used. We reproduce the mint figures in the accompanying chart for the years since 1873, and for comparison give also the *Economist* figures, which indicate the course of prices in England. It should be said that, for both countries, the standard (indicated by the number 100) is the average range of prices of the years 1845–50. Those were the years just before the Australian and Californian gold discoveries, and the average for them has always been used by the *Economist* as the basis of comparison in its table of prices.

We have arranged the mint figures on the same basis, using for that purpose the figures for 1845–50 given in the earlier mint report. This method of comparison is of course open to objections, but seems on the whole to be the best:



The figures begin with 1873, a year of speculation and of inflated prices all over the world; and it will be seen that in both countries prices fell continuously during the long years of depression from 1873 to 1878. The fall in England was from 134 to 116; and in England there was in 1879 a still further fall to 100. That is, in 1879 prices in England had gone down to the level of the years 1845–50. In this country, the fall from 1873 to 1878 was from 124 to 102. The revival began here earlier than in England, and from 1878 to 1879 there was already a rise from 102 to 109. After 1879 the tendencies in both countries for a few years was to a rise. A temporary fall, it is true, is indicated in the United States from 1879 to 1880; but one cannot but look at this fall with suspicion, and ascribe it, at least in part, to some of the mistakes made in calculating the mint figures. In England the highest point since 1878, according to the *Economist*, was reached in 1880. But there are reasons, which there is not space to explain, for ascribing the high figure for that year to the peculiar methods of the *Economist*, and for believing that there was in reality but little fall in 1882 as compared with 1880. In the Uuited States there was a fairly steady rise from 1878 to 1882. Since 1882 there has been a steady fall in both countries. Last year (1884) prices were at 101 in England, and at 106 in this country; in other words, notwithstanding the severe depression, they had not gone so low as the lowest points reached during the last period of depression in England in 1879, and in this country in 1878. F. W. Taussig.

THE NEW PHILOLOGY.

The new school of philology in Germany, of which Professor Brugmann is one of the ablest representatives, claims to be a legitimate advance on its predecessors in the direction of scientific sobriety and precision. The older scholars from Bopp down to a few years ago, says Sievers (in his article on Indo-Germanic philology, in the Encyclopedia Britannica), had naturally occupied

themselves largely with glottogonic problems; and some of them had adopted misleading metaphors, as Schleicher in his theory that language was an organism, and linguistics one of the natural sciences. Brugmann, in a recent pamphlet,[1] charges further that mechanical methods were employed in comparisons of words, as when the fullest form was judged to be always the oldest. The new school discards glottogonic problems, on the ground that the materials for their discussion are, at least at present, insufficient, rejects the misleading metaphors, and abstractions in general, and professes to confine itself to known facts. But the principle on which it lays most stress is that "our general views of language and methods of comparison should be formed after study of living languages, because these alone are controllable in detail, and can give an insight into the motive forces that shape and modify language" (Sievers). The most prominent of these forces are held to be two: phonetic variation, to whose laws there are no exceptions, and which is differentiating in its tendency; and analogy, an assimilating force, whose procedures cannot be reduced to rule. An example of the first is the separation of the old English short *a* (pronounced as in Italian) into two sounds, that in *mare* before *r*, and that in *make* before all other consonants; an example of the second is found in the plural of *book*, which was formed in the older language simply by change of vowel, like *feet* from *foot*, but was afterwards assimilated to other plurals in *s*.

These are the views that Brugmann defends in his pamphlet. It consists of three pieces. The first, an address delivered when he entered on the duties of his university chair, is a statement of the relation between linguistics and philology. Defining the latter, after Böckh, as the science that investigates the historical manifestation of the mind of peoples, that is, their development of culture, he points out that the science of language is merely one branch of this larger department, and that all attempts to draw a line between them have failed. After exhorting scholars of all linguistic departments, wider and narrower, Indo-Germanists, Hellenists, Latinists, Germanists and others, to work in harmony, he gives a short sketch of the progress recently made in the systematic investigation of the general vital conditions of language. The foundation for this, he says, was laid by Wilhelm von Humboldt, and Steinthal, and W. D. Whitney had also contributed; Scherer, in 1868, showed the importance of analogy in the explanation of older forms, and Leskien soon after announced the doctrine that the laws of phonetic variation are in themselves subject to no exception. Other scholars, among whom are Osthoff, Paul, Delbrück, Sievers and Brugmann, have continued the investigation and application of principles. Brugmann closes with the expression of the opinion that for young students of classical and Germanic philology, while Sanskrit is important, it is still more important to understand the nature of language and the laws that govern its growth.

The second and longest paper is Brugmann's reply to a 'Criticism of the latest linguistic investigations' by Georg Curtius, whose recent death has deprived Indo-Germanic philology of one of its most distinguished and useful workers. Curtius had treated of four points: phonetic laws, analogy, the Indo-Germanic vowel-system, and the origin of primitive Indo-Germanic forms; Brugmann takes these up in the same order. The principle of the constancy of phonetic laws, defended by the new school against Curtius, is understood by them to mean that the same sound under the same conditions always moves in the same direction and undergoes the same change,—there are no exceptions or irregularities. Brugmann draws his proof of this proposition from a consideration of the physical and psychical processes concerned in the production of words, and the way in which the individuals of a community act on one another in the production of sounds. Phonetic change, he says, is at the same time a psychical and a physical process: individuals are constantly modifying their pronunciation, but the modifications are controlled by the necessity of being understood by the community, and thus all the members of the community necessarily move on together; when the phonetic change is completed, it is inconceivable that in different words different courses should be taken, for the pronunciation is not learned separately for each individual word, but the same phonetic conditions necessarily induce the same feeling and the same pronunciation. Curtius insists that many unexplained cases of phonetic change exist, and that an inductive demonstration of the constancy of the law of phonetic change is impossible. Brugmann admits that such demonstration is, in the nature of the case, impossible, since so much of the necessary material has perished, but holds that the number of unexplained changes is constantly diminishing, many of the seeming 'exceptions' to rules depending on false etymologies, or resulting from the fact that one dialect has borrowed from another, in which different laws of literal interchange exist, or being otherwise explicable. Curtius thinks that a letter is sometimes retained in a particular form, when it has disappeared from

[1] *Zum heutigen stand der sprachwissenschaft.* Von Karl Brugmann. Strassburg, *Trübner*, 1885. 144 p. 8°.

phonetically similar forms, because it was felt to be significant; Brugmann replies that the processes of phonetic change are unconscious, quite ignoring the meaning of sounds, as, in fact, we often find that phonetic decay removes letters that we know to have been originally significant.

The second principle discussed by Curtius, analogy, is one the influence of which has always been more or less acknowledged by writers on language; but it has usually been regarded as a secondary and sporadic force, leading (as the current expression 'false analogy' indicates) to malformation and confusion. The new school holds, on the contrary, that analogy is a natural, universally active force, equally prominent in the processes of forming and of learning languages. In our ordinary speaking, words present themselves to us in groups, and a new word is assigned to its most natural group, and treated accordingly. "The action of groups is, along with phonetic change, at least in our observation of accessible periods, the most important factor in the development of language" (Paul). A familiar example in English is the tendency to convert strong preterites into weak, as 'crowed' instead of the old 'crew.' The analogic process, being thus assimilative, acts in opposition to the differentiating influence of phonetic change, which more commonly tends to destroy the similarity between words. The younger philologists call in the principle of analogy to account for a number of phonetic phenomena, which the older generation of scholars either treated as unintelligible anomalies or endeavored to explain by referring them to the desire to retain significant letters, etc. Curtius objects to this wide extension of the principle, on the ground that its employment is arbitrary, and that it rests on no better basis than the admitted usage of modern languages. Brugmann rejoins that there is no reason to suppose a difference in this respect between ancient and modern languages; and Delbrück, in his 'Einleitung in das sprachstudium,' endeavors to define the character of analogical change.

The third and fourth points of Brugmann's reply to Curtius relate to questions of Indo-Germanic grammar, such as whether the primitive Indo-Germanic language had not only the vowels *a*, *i*, *u*, as the older school holds, but also *e*, *o*, together with diphthongs and sonant nasals and liquids, and what the origin of the inflections was. Brugmann remarks that the new philology does not absolutely avoid all glottogonic or morphogonic problems, but only those in which there are clearly not sufficient data for a solution; and whether it is worth while to attack any given problem, each man must decide for himself. Finally, in the third piece of his pamphlet, Brugmann replies to some points made by Johannes Schmidt.

The new philological school may be said to represent a more rigid adherence to law in the treatment of linquistic questions. While gratefully acknowledging the eminent services rendered to the science of language by Bopp, Grimm, Pott, Benfey, Schleicher, Curtius, and others, it claims to carry out more consistently the principles they lay down, and to fill in part the gaps they left.

C. H. Toy.

CHEMICAL NOMENCLATURE.

A committee of fourteen chemists, including such eminent men as Williamson, Frankland, Crum Brown, Odling, and Armstrong, presented their third report on chemical nomenclature to the British association at the Aberdeen meeting. This committee was entrusted with the duty of "drawing up a statement of the varieties of chemical names which have come into use, and of indicating the causes which led to their adoption, as well as considering what can be done to bring about some convergence of the views on chemical nomenclature obtaining among English and foreign chemists."

This weighty committee produce, as might be expected, an eminently conservative report; they regard as ill advised any attempt, on etymological grounds, to change a system so firmly established as that involved in the present use of the prefixes *hypo* and *hyper*.

After confirming the terminations *ic* and *ous*, the committee considers the minor question how far the termination *ous* ought to be written in the forms *ious* and *eous*. The answer is: as seldom as possible; cupreous has given way to cuprous, and 'ruthenious' and 'iridious' should also lose the superfluous *i*.

In answer to the question whether the termination *ic* should be employed in the names of salts of which only one class is known—as magnesic sulphate instead of magnesium sulphate, the committee says: "There is something to be claimed for both systems; and, as the diversity of practice does not lead to confusion, the question need not be regarded as vital." In our opinion, the committee might have exerted their influence to suppress the use of the unmeaning and often non-euphonious termination *ic*. Such terms as 'zincic' and 'nickelic' offend the ears of hearers; 'scandic' and 'ytterbic' would be unwelcome.

The committee calls attention to the advantage of affixing the syllable *ic* to the names of positive radicals in ethereal salts. The ambiguity arising in *speaking* ethyl phenylacetate, which might be taken for ethylphenyl acetate, can be obviated

saying ethylic phenylacetate, and ethylphenylic acetate.

It is further remarked that of late years chemists have not been sufficiently careful in applying numerical designations to substances; thus arsenious oxide is sometimes called arsenic trioxide, although the formula of gaseous arsenious oxide is As_4O_6.

The committee considers at some length the nomenclature of acid salts, of basic salts, of sulphur salts and of double salts, pointing out some inconsistencies, suggesting some changes and proposing, very sparingly, new terms. Being the third report, many topics treated previously are not touched, and the report is consequently not very wide-reaching.

In this connection, we remark that the London chemical society, a few years ago, issued to the abstracters for its journal a series of instructions on chemical nomenclature and notation, which have been of the greatest service in securing uniformity in writing chemical language. American chemists are largely following the instructions and simple rules there laid down; and, so far as the English language is concerned, a commendable uniformity and perspicuity already obtains.

H. Carrington Bolton.

POISONOUS WATERS IN THE COCOS OR KEELING ISLANDS.

In a recent book of travel[1] from the pen of Henry O. Forbes of Aberdeen, Scotland, an account is given of a visit to the Cocos or Keeling Islands, which contains some new facts bearing on the history of coral islands that are specially interesting, as they supplement the studies of Charles Darwin at the same locality. The Keeling Islands, as they are usually called, are situated in the Indian Ocean about 800 miles southwest of the Straits of Sunda. They were visited by Darwin in 1836, and by Forbes in 1878. It was while exploring these islands that Darwin's well-known hypothesis of the formation of coral reefs and atolls first suggested itself.

One of the most instructive portions of Mr. Forbes's observations relates to the rising of poisonous waters in the lagoon enclosed by the Keeling Islands, immediately after a cyclone which occurred January 28, 1876, a description of which was furnished by Mr. G. C. Ross, the present proprietor of the islands.

On the 25th the mercurial barometer indicated some unusual atmospheric disturbance, and the air felt unusually heavy and oppressive. On the 28th it fell to close on 28 inches, a warning which gave time for all boats to be hauled to a place of safety, and other preparations for a storm to be made. On the afternoon of the same day there appeared in the western sky an ominously dark bank of clouds, and at 4 P.M. a cyclone of unwonted fury burst over that part of the Indian Ocean. About midnight on the 28th the sea rose suddenly, and rushed inland more than 150 yards from high-water mark. The storm attained its greatest height about one o'clock on the morning of the 29th. At that hour no object raised a foot or two above the ground could resist its fury. The inhabitants saved themselves only by lying in hollows of the ground. To what distance the barometer might have fallen it is impossible to say, for the mercurial was carried away; two aneroids gave it at 26½ inches.

The following morning broke bright and calm, but not a speck of green could be seen anywhere within the compass of the islands. Round the whole atoll the solid coral conglomerate floor was scooped under, broken up and thrown in vast fragments on the beach. On the eastern shore of Home Island, Mr. Forbes observed a wall of many yards breadth, portions of which had been thrown up clear over the external high rim of the island, and several yards inward among the cocoanut trees.

About 36 hours after the cyclone the water on the eastern side of the lagoon was observed to be rising up from below of a dark color. The origin of the spring, which continued to ooze out for about ten or fourteen days, lay somewhere between the north end of New Selima and the north end of Gooseberry Island. Its color was of an inky hue, and its smell 'like that of rotten eggs.' From this point it spread southwest as far as the deep baylet in Southeast Island, where, meeting the currents flowing in at the westward and northern entrances, which run, the one round the western, the other round the eastern shore of the lagoon, its westward progress was stopped; whereupon, turning northward through the middle of the lagoon (becoming slightly less dark as it proceeded) it debouched in the ocean by the north channel. Within twenty-four hours every fish, coral and mollusk, in the part impregnated with this discoloring substance —probably hydrosulphuric or carbonic acid—died. So great was the number of fish thrown on the beach, that it took three weeks of hard work to bury them in a vast trench dug in the sand.

At the time of Mr. Forbes's visit the islands were slowly recovering from this sad disaster. He carefully examined that part of the lagoon over which the poisoned waters flowed, and described its effect as follows: "The whole eastern half of the lagoon

[1] *A naturalist's wanderings in the Eastern Archipelago. A narrative of travel and exploration from 1878 to 1883.* New York, *Harper*, 1885. 8°.

was one vast field of blackened and lifeless coral stems, and of the vacant and lusterless shells of giant clams and other mollusks, paralyzed and killed in all stages of expansion. Everywhere both shells and corals were deeply corroded, the corals especially being in many places worn down to the solid base. Since the catastrophe there has been, till almost the date of my visit, no signs of life in that portion of the lagoon; I saw only a very few fishes, and only here and there a new bunch of Madrepora and Porites."

A similar field of dead corals was observed in this lagoon during the visit of the Beagle in 1836. The destruction of the corals was accounted for by Darwin, by assuming that Southeast Island had at one time been divided into several islets by channels whose closing up had prevented the water in the lagoon from rising so high as formerly; and that, therefore, the corals, which had attained their utmost possible limit of upward growth, must have been killed by occasional exposures to the sun. This statement is cited by Forbes who, judging from the fact that an earthquake took place at the Keeling Islands two years before the visit of the Beagle, considers it very probable that an eruption of poisoned water, like that of 1876, may have been brought about by the earthquake, and may have caused the death of the corals observed by Darwin.

Mr. Forbes thinks that an earthquake took place at the time of the cyclone in 1876, although no tremblings of the earth were noted by the people on the island. He considers "the waves, as well as the darkened waters which were issued, doubtless from a submarine vent, as almost certainly the result of volcanic disturbance in close vicinity of the atoll." It seems to the present writer, however, that this hypothesis is but poorly sustained by the facts observed. A similar rising of the waters is recorded in connection with other cyclones. Chain Atoll, in the Low Archipelago, was completely devastated by a hurricane in 1825, during which not less than 300 lives were lost. Thus in two instances, the agitation of the sea about atolls during great storms has been so great as to suggest earthquakes, yet no shaking of the land was recorded in either instance. The only safe conclusion, therefore, seems to be that extremely violent storms are capable of causing the sea to rise to a much greater height than had been supposed. On the other hand, certain writers, who consider that earthquakes may be brought about by a dimunition of atmospheric pressure, might claim these as striking illustration of their hypothesis, providing positive evidence of the occurrence of earthquakes in connection with the storms could be had.

The eruption of this colored water, charged with sulphuretted hydrogen etc., in the lagoon of the Keeling Islands, might perhaps be accounted for, by assuming that the relief of atmospheric pressure, during the cyclone, allowed the gases originating from the decomposition of organic matter imprisoned in the mud of the lagoon to rise to the surface. As the atolls are entirely of organic origin, it seems by no means improbable that organic matter in a state of decomposition might occur in the mud beneath the lagoon in quantity sufficient to account for the phenomena observed.

Another cause adequate to destroy mollusks, coral polyps, etc., in the lagoon of an atoll, is furnished by rain, which frequently freshens the water, as has been noted by both Darwin and Forbes.

THE NIPON CENTRAL EDUCATIONAL ASSOCIATION.

THE main object of this association is to promote the interests of education and science in Japan. Its regular meetings are held monthly in the Lecture hall of the Tokio university, and at these times a lecture is usually delivered by some prominent member, or papers upon educational or scientific subjects are read. There is a standing committee whose duty it is to give all possible information sought on the part of the local associations or others.

The association publishes monthly bulletins, which are distributed among its members. These bulletins contain reports or reviews of the lectures delivered and papers read at the regular meetings, and also other papers upon educational and scientific matters. The number of members of the association is, at the present time, about four thousand; and it is a matter of congratulation that the number is monthly and yearly increasing. The government recognizes the association as one calculated to promote the interests of education and of science in general, and annually votes it a money appropriation or subsidy.

EXCAVATION OF THE TEMPLE OF LUXOR.[1]

OF all ruins, or groups of ruins, in the land of Egypt, the temples and tombs of 'hundred-gated Thebes' stand foremost in majesty, variety and number. Here six great temples mark the site of a city, which for many centuries was the capital of the known world. Of these six temples, the four on the left bank are known to travellers and readers of travels as Goornah, Dayr-el-Baharee, the Ramesseum, and Medinet Haboo; the two on the right bank being Karnak and Luxor.

By far the most accessible, and consequently

[1] Condensed from the *Illustrated London news.*

the most familiar, of these half-dozen Theban temples, is the great Temple of Luxor, which has just been excavated by Professor Maspero. Yet, till now, Luxor has not in itself been nearly so rich in objects of interest as any of the neighboring sites. Not only was the great temple three-fourths buried under the accumulated rubbish of ages, but its courts and colonnades formed the actual nucleus of the Arab half of the modern village. The Moslem population has settled, apparently from mediæval times, in and around the temple, at the southward end of the mound. Here, building always with mud bricks crudely dried in the sun, each generation erecting its congeries of hovels on the ruins of the hovels made by its predecessors, the Arabs of Luxor have gone on from century to century accumulating rubbish upon rubbish and mud upon mud, till they have thrown up an artificial hill some forty-eight or fifty feet in height. As the hill rose, the temple necessarily became swallowed up.

To sweep away all these barracks, stores, houses, huts, pigeon-towers, stables and refuse-heaps, has been the earnest desire of Professor Maspero, ever since his acceptance of the important post left vacant, in 1881, by the death of Mariette Pasha. He obtained from the Egyptian minister of public works the necessary authorization for treating with the fellaheen, the basis of the negotiation being that each squatter should receive a cash indemnity for his house and a piece of land equivalent in extent to the area covered by the said house and its dependencies. It was further arranged that the Egyptian government should find the money for the liquidation of the indemnities. Some of the temple-folk would sell, and some stoutly refused to be bought out, except upon such terms as made negotiation well-nigh impossible. Meanwhile, there was another financial question to be settled,—namely, the expenses of excavation. The Egyptian government had paid the indemnities, and could do no more; yet, to get rid of the squatters was of little avail so long as there remained fifty feet of soil to be cleared and carted away. A subscription, simultaneouly started in the *Journal des débats* and the London *Times*, met, however, with so liberal a response (especially in Paris), that this question of ways and means was settled in two or three days, and in the month of July, 1884, the order was given to commence operations.

Our illustration shows the courtyard of Amenhotep III. with the excavations in progress. We here find ourselves admitted into the precincts of the courtyard, immediately behind the government store-house, of which one corner and a small window are seen between the pillars to the right. The spectator stands with his back to the Arabian chain and his face to the Libyan range, one long spur of the great western mountain and a glimpse of the Nile being visible behind the highest group of Arabs to the left of the picture. The mud huts, the mud walls built up between the columns, the asses, and goats, and village folk, are still in part occupation of the place. To the left, however, a hovel or two have been demolished; and, on the rubbish heap thus created, we see a group composed of two Europeans and some five or six better-class natives.

EXCAVATIONS GOING ON IN THE COURT YARD OF THE TEMPLE OF LUXOR.

— The *Athenæum* states that "somewhat late in the day the inhabitants of Syracuse have erected a monument to Archimedes."

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SCIENCE.

FRIDAY, OCTOBER 30, 1885.

COMMENT AND CRITICISM.

THE NEW YORK *Evening post* of Oct. 21 publishes an editorial on the underground wire problem, in which a magnificent solution of the problem of burying the wires is offered. Along Broadway, just outside the curb line of the street, there is to be constructed a capacious underground gallery, wherein all the present impedimenta must be placed, and any obstruction which the workmen may encounter in the building of this gallery is to be removed. Herein are to be placed the steam, gas, sewer, pneumatic, hydraulic, and various other pipes, in addition to the wires of the various electric companies. The other streets of the city are to be tunnelled on a similar though less elaborate plan.

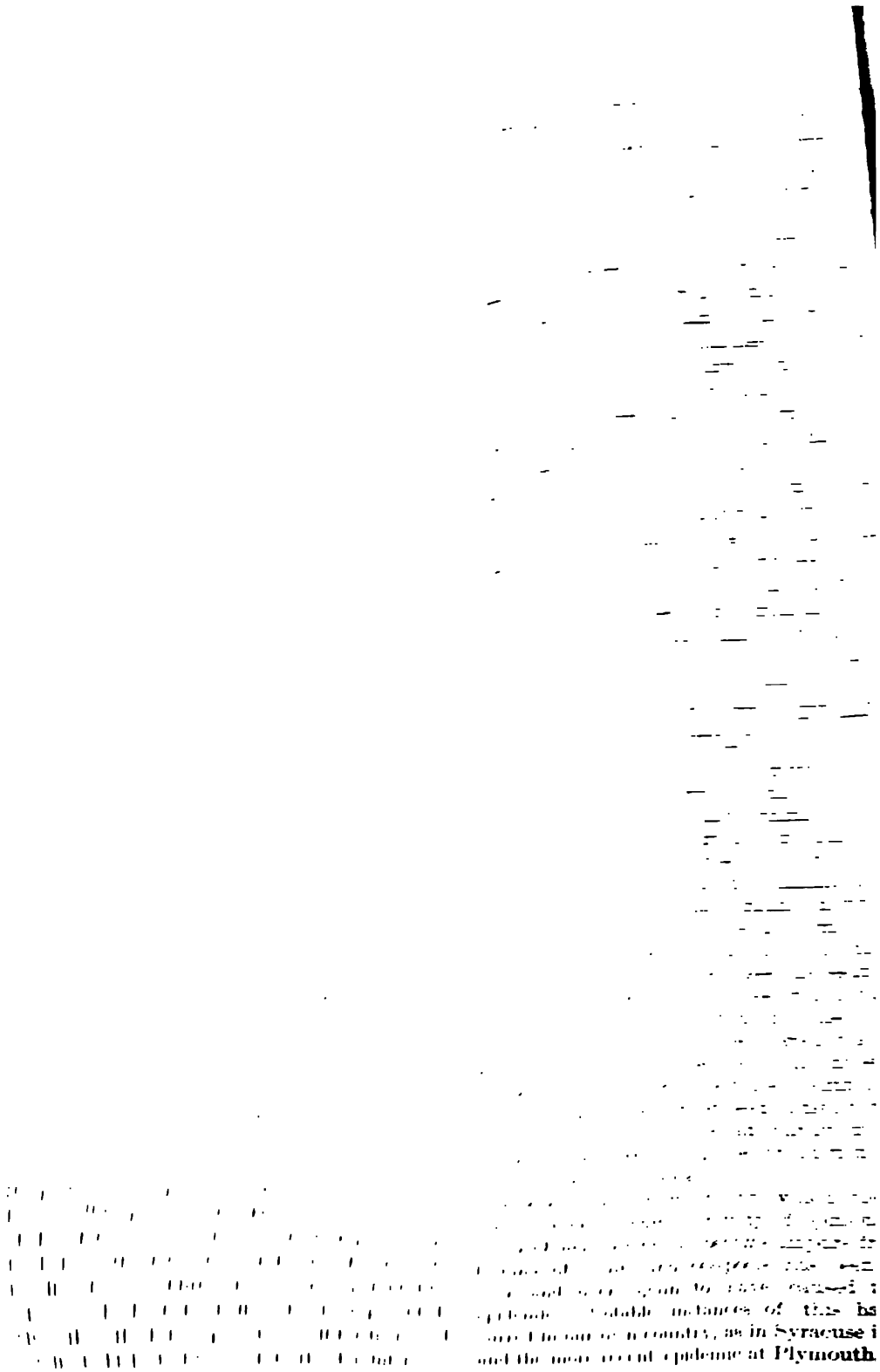
Magnificent as this plan may seem, it is hardly an exaggeration of what the underground commission actually proposes to require. They have caused it to be understood that they will consider no plan of placing the wires underground which does not combine all kinds of wires in a single conduit, with an arrangement by which access to every house may be obtained without excavation of the street. The question that interests the various electrical companies is, "Who is to undertake this extensive piece of engineering, and who is to pay for it?" Certainly, the commission has no power to construct such conduits, and, even if it had, it is difficult to see how the various electrical companies could be compelled to make use of them, or to pay for such use.

That it is not only technically possible, but economically practicable, to put the large mass of city wires underground, was admitted by the electrician of the American Bell telephone company, Dr. W. W. Jacques, in an article published in *Science* of July 3 of the present year, and the Metropolitan telephone company, whose mileage of wire in New York City is greater than that of any other company, has actually asked permission of the commission to put a part of its wires underground, and such permission has been refused. The reason why the wires in New York are not placed underground, and why they are not likely to be placed underground at present, is, not that it is technically impossible, and not that the parties operating them do not desire to place them underground, but because the commission insists upon its being done in accordance with an entirely impracticable plan.

IT WOULD BE INTERESTING to know just what evidence Mr. St. Pierre, the Canadian lawyer, who has recently given a theory of small-pox to the newspapers, has found, which leads him to the conclusion that small-pox is "indigenous to Canada," and "is to Montreal what yellow fever is to New Orleans, or ague to New Jersey." That it is to Montreal what yellow fever is to New Orleans we can well believe, for it is now conceded by the best sanitarians that yellow fever never appears in this country anywhere except when imported from abroad. And unless Mr. St. Pierre can give us something more reliable than Indian tradition, even though it comes from the oldest inhabitant, we shall be inclined to the now well-established opinion that small-pox was brought to this country shortly after its discovery by Columbus.

From the well-known aversion to vaccination which characterizes the French Canadian, we can well believe that small-pox has prevailed there in a more or less epidemic form so long that history fails to tell its first appearance, but we have no doubt that its termination would be very soon recorded if the vaccinators were permitted to have their way.

AGAIN THE PAPERS are flooded with paragraphs concerning great mortality of fishes in the Gulf of Mexico, and such headings as 'Twenty miles of dead fish,' or 'A fish pestilence in the Gulf.' Sensational as such notices at first sight appear, they can scarcely be pronounced to be exaggerations. Records show that as far back as 1844 a widespread destruction of all sorts of salt-water life occurred along our southern coasts; again in 1854, 1878, 1879, and 1880. It was in the winter of 1881–2 that a catastrophe of similar nature took place off



many times been the medium the typhoid poison has been dis- pure water has been used to wash ans, if, indeed, it has not served and the milk has thus become in- ing example of this medium of he outbreak of typhoid at Maryle- Within a few weeks 123 families Mr. Radcliffe traced the cause of milk, which came from a par- which "water used for dairy pur- d excremental matters from a g from enteric fever, immediately e time of the outbreak."

curring at Edinburgh, Glasgow, blin have also been traced to milk. ld stir up all health officials to the e of the most rigid scrutiny of the to the people under their charge, l our judges to inflict the severest those detected in the adulteration ential food.

ease may be contracted by those sick is possible, but if this ever emely rare. The discharges from e believed to contain the infective the present state of our knowledge ischarges in the ground, or to cast wer without previous disinfection, upon as criminal. It is not diffi- nd that the infective material of cted discharges may cling to the in pipes and sewers, and through bing find admission to the dwell- g rooms of the well. This is doubt- ation of the origin of those cases bed to sewer-gas.

er is eminently a disease of the s greater prevalence at this season ttributed by some to the decay of ers claim to have found its preva- upon the rise and fall of the ground ow far these conditions affect the he fever is a matter of conjecture, e entirely beyond our control we deavor towards prevention and re- rict attention to cleanliness in all especially to the thorough disinfec- charges from patients. For this ommittee on disinfectants of the lic health association recommend oride of lime, of chlorinated soda, of mercury.

the typhoid patients are largely re- e ranks of those of ample means, e summer spend their time in the ften at the most fashionable water- ing places. It is notorious that these resorts are, as a rule, unsanitary in their appointments. The crowding of human beings in such places, with the consequent accumulation of human waste, would, it would seem, help to account for the large representation of typhoid fever victims in the ranks of their patrons. A study of typhoid cases with reference to this point would be interesting and doubtless instructive.

MAN AND THE MASTODON.

THE finding of the tusks, teeth, and portions of the skull of a mastodon last November in Northborough, Worcester county, Mass., has led to the important discovery of a human skull, in close connection with the remains of the mastodon. The facts briefly stated are as follows: Mr. Wm. U. Maynard, while having a ditch dug through a peat bog on his farm in Northborough, near the Shrewsbury line, last November, found portions of the skull and teeth of a mastodon lying on the hard pan under eight feet of peat. The specimens were exhibited to the members of the Worcester society of natural history and Worcester society of antiquity, by Dr. F. W. Brigham, to whom they had been given by Mr. Maynard. The teeth were afterwards taken to Cambridge by Mr. Thomas A. Dickinson, an officer of the Natural history society, and were pronounced by Mr. J. A. Allen, of the Museum of comparative zoölogy, to be those of a mastodon about two-thirds grown. An account of the discovery was written soon after by Mr. Franklin P. Rice of Worcester, and printed by the natural history society. A figure of one of the teeth is given.

Early in the present month, arrangements were made with Mr. Maynard by members of the two societies named, acting under the direction of Dr. W. H. Raymenton, president of the natural history society, to make further excavations in the peat bog for the purpose of finding the rest of the bones of the mastodon. While digging eighteen feet to the southwest from the spot where the mastodon skull was found the preceding season, the workmen exposed the top of a human skull, which was at once taken up by Dr. Raymenton, who was superintending the work; and he states that the skull, which he worked out of the enclosing peaty matrix with his fingers, was resting on its basal portion directly on the blue clay and stones. The under jaw was found, teeth downward, about eight inches to the south of the skull, and in immediate contact with the clay. The evidence of several witnesses is conclusive on these points.

Dr. Raymenton and Mr. Dickinson immediately informed me by letter of the discovery; but, owing

to my absence from home, I was unable to visit the place until Oct. 17, four days after the skull had been found. During this visit, I made a careful study of the peat formation and the underlying blue clay, which I take to be the bowlder clay covering the bottom of the basin or old pond, which is some four or five acres in area. Over this blue clay, containing both rounded and split stones, the deposit of peat has taken place. The two skulls, mastodon and human, were unquestionably at the bottom of this peat, both resting on the blue clay; but, owing to the inclination of the basin toward the northeast from the spot where the human skull was found, there were two feet less of peat over the skull than there were over the mastodon. The stratification of the peat was quite marked, and the lower portion immediately covering the two skulls is very fine, and evidently a deposit made entirely under water. Above this the peat is slightly coarser, which character increases to the surface. While a few small pieces of wood were found at the bottom of the peat, several large logs, and what seems to be the remains of a partially burnt stump, were found in the layer about two feet above the human skull. To this depth heavy objects could have readily sunk through the coarse or more open formation above, but I question the possibility of so light an object as a human skull sinking through the lower two feet to the hard pan at any time subsequent to the formation of that stratum. That both skulls were transported, seems to be proved by the fact that no other bones of the two skeletons were found in the immediate vicinity; and that they were transported by water before the peat deposit began, seems probable. The broken portions of the human skull have the appearance of having been worn by water action, and the dissociation of the jaw and cranium would also indicate that method of removal from the rest of the skeleton. Had it been a settling of a heavy body through the peat, we could hardly expect that the skull and jaw alone would have settled to hard pan, and the rest of the bones of the skeleton to have been nowhere near them; and the same remark would apply to the skull of the mastodon.

The skull has been placed in my hands for careful study and comparison, and I hope soon to be able to give definite information in regard to it. Unfortunately, the skull is not a typical one, and the averaging and careful balancing of its characters will have to be made before its race affinities can be determined. In regard to its color, I may add that it is as deep, if not deeper brown, than the bones of the mastodon. Its comparatively perfect preservation when compared with the mastodon skull is, however, remarkable; but this could be easily accounted for by the le posure of the mastodon bones on the sur gravel deposit before being washed into t

F. W. P

THE INTERNATIONAL GEOLOGIC GRESS AT BERLIN.

THE third and most important sessio International geological congress, which tuted by an American committee of the association at its Buffalo meeting in 1876 been held.

The first session at Paris in 1878 wa *pour parler* which broke ground. The sion at Bologna in 1881 accomplished s but was especially useful in preparing work of the session just closed by decidi duce a geological map of Europe on a 1: 1,500,000 and intrusting its execution to mittee, while another was appointed some scheme for unifying the nomencla where possible, of fixing the limits o congeries of beds, which had heretofore ferently understood by different geologi obstacles which faced these committees once understood from this bare staten will modify any hasty impression that in little has been accomplished.

The two committees, or a majority of of each, met at Foix and at Zurich durin years which intervened between the con Bologna and Berlin, and the action of the which has just ended was almost exclus fined to the propositions made in the print of these committees.

Those who arrived in Berlin some da the opening of the congress found at t Bergakademie on the Invaliden strasse t organized to examine the credentials of and provide each with the necessary ca ceipt for the ten marks he paid, besides a silver, bearing the inscription on one side gorum conventus, mente et malleo,' wit ventional mallet and chisel crossed, and su by a wreath of oak. On the other side, similar wreath, were the words, 'Berl The medal was suspended by a white sati and worn on the lapel of the coat for ide on excursions, etc.

A programme of the order of event thus condensed: Monday, September A.M., meeting of the council at the R gebäude; 5 P.M., social re-union of the of the congress in the ante-chamber of t Tuesday, September 29, 9 A.M., openin congress; 2 P.M., visit to the Bergakade

the collections and the objects sent to the congress. Wednesday, Thursday, Friday, and Saturday, sitting of the congress at 2 P.M.; 7 P.M., Saturday, close of the congress. Sunday, 9 A.M., excursion to Potsdam. Then followed announcements of the excursions to the Hartz, to Stassfurt, etc. This programme was followed in the main, only an extra session of the congress being intercalated. The usual course was to devote two hours to the discussion of the committees' reports (2 to 4 P.M.), and the last two hours (4 to 6 P.M.) to scientific discourses of various delegates.

The weather during the entire week was very disagreeable, cold and rainy. On Sunday morning, after the close of the congress, it promised to be fair, but only to deceive the hopes of those who took part in the Potsdam excursion. The commencement of the trip was very beautiful, but towards the close it degenerated into a procession of dripping and shivering people, who tried to look as if it were pleasant in order not to offend their kind hosts.

The language of the congress had been decided upon as French; and this, no doubt, accounts for the greater share taken by the Swiss, Belgians, and French in the debates, than by the people of other nationalities. The Germans, for instance, who outnumbered all other nationalities taken together, had only one representative, who managed the language with fluency, and led in debate, —Hauchecorne, the active spirit of the congress. It is true that Neumayr (an Austrian) did retort very effectively once to M. Lapparent, and his Excellency v. Dechen spoke frequently, if not easily; but Dr. Beyrich, the nominal president, was entirely unintelligible, and Stur was obliged to get a dispensation from the congress and speak in German.

On Tuesday evening at 6 P.M. the first report was given by M. Renevier of Switzerland, the secretary of the committee appointed to prepare the European map, which was thus constituted: Beyrich and Hauchecorne (forming the sub-committee of direction in Berlin), Germany; Daubrée, France; Giordano, Italy; de Moeller, Russia; Mojsisovics, Austria-Hungary; Topley, Great-Britain; Renevier (secretary general), Switzerland. The committee of direction had made an arrangement with D. Reimer & Co., of Berlin, according to which this firm agreed to undertake the publication of the map at its own risk, provided the committee would guarantee them an edition of 900 copies, at 100 francs a copy, and would give them sums on account in advance.

The map is to consist of 49 sheets, 7 in breadth and 7 in height. Each of these sheets is 48x53 cm., and the whole of them together will form a chart 3.36 metres high and 3.72 metres broad. Prof. Kiepert of Berlin is to prepare the topographic base, using for this purpose all data at his disposition, both published and unpublished. Great Britain, France, Spain, Italy, Austro-Hungary, Germany, Scandinavia, and Russia, each takes 100 copies. The remaining 100 copies are to be divided between the six smaller states, Belgium, Holland, Denmark, Switzerland, Portugal, and Roumania. The central committee is to receive from each national committee the map of its country, and to make them harmonize.

The report ended with the following six resolutions, which the committee asked the congress to pass:—

1°. M. Karpinski will succeed M. de Moeller (resigned) in representing Russia on the committee.

2°. The carbonic system (or Permo-carboniferous) shall be represented on the map by three distinct shades of gray.

3°. Brown shades will be applied to the 'Devonic.'

4°. The color to represent the 'Siluric' is left to the discretion of the committee.

5°. The eruptive rocks shall be represented by seven tints, ranging from bright red to dark brownish red.

6°. The determination of the other questions mentioned in the report shall be left to the discretion of the committee.[1]

Proposition 1° was adopted without dissent. Proposition 2°, after much opposition, was agreed to, with the understanding that the proposed method of the committee should not be understood to have any bearing on the scientific settlement of the question, but should be regarded purely as a provisional expedient adopted in order to complete the map. Proposition 3° was agreed to. Proposition 4°, after strong opposition from Prof. Hughes and M. Jacquot, was finally so modified as to allow the committee to adopt it provisionally for the purposes of the map, without prejudging the abstract scientific question at all, and thus carried. Propositions 5° and 6° were carried without objection.

Sept. 30, at 2.30 P.M., the congress re-assembled to take action on the report of the committee on the unification of nomenclature, which was then presented by M. Dewalque. This report had been in the main adopted at the Bologna congress, a few minor

[1] The questions here referred to comprise several matters about which the committee was in doubt: e.g., (*a*) How are the terranes to be represented, of which the subdivisions were doubtful? (*b*) How are those subdivisions to be indicated which are too small to appear on the scale of 1:1,500,000 adopted for the map? (*c*) How are measures to be represented when even their age is doubtful? (*d*) How represent subdivisions concerning the affiliations of which geologists differ (Gault, Rhetic, etc.)?

points having been left for future adjustment. They concerned, for the most part, definitions of terms, such as 'group,' which it was determined should be applied to the divisions of the highest order (secondary group, etc.); the next division should be 'systems' (Devonian system, etc.); the third should be 'series' (coal-measures series of the carboniferous system); the fourth division should be 'stages' (*étages*) (millstone grit, etc.); the division of the fifth order was decided upon (for French only) as 'assise' or 'couches;' 'zone' should be used for a number of beds having one or more fossils to characterize them, but it should be inferior to 'stage' as a term of classification. 'Bank' was selected to imply a bed (*couche* or *assise*) thicker or more coherent than those in its vicinity, among which it is intercalated. These, and certain conclusions as to the application of the terminations 'ary', 'ic', and 'ian,'—the first for the groups, the second for the series, and the third for the stages,— completed the linguistic portion of the report. No termination for systems was proposed.

It was decided to give to the pre-palæozoic rocks the name 'archæan' instead of 'primitive,' and, while recognizing three divisions of them, to allow each geologist to distinguish these by petrographic characters.

On the motion of Prof. Archibald Geikie, the decision as to the limits of the Silurian and Cambrian is left till the meeting of the congress in London in 1888, but the committee on the chart has liberty to divide the lower system of the palæozoic group into three parts, of which the names shall be determined upon later.

After a long and exciting discussion, the propositions were accepted: (*a*) that the Devonian should be divided into three parts, corresponding respectively with those termed the Rhenan, the Eifelian, and the Famennian; (*b*) that the calceola beds should form part of the Eifelian; (*c*) "that the upper limit of the Devonian should be drawn at the base of the carboniferous limestone, that is to say, the system which includes the Psammites of Coudroz, and the upper Old Red." [The words "the lower carboniferous (Kilborkan, Marwood, Pilton)," and "or the calciferous sandstone Dura, Den," were stricken out of the committee's resolution, at the request of Prof. A. Geikie, as not representing the real association of these beds.] The whole paragraph (*c*) was afterward suppressed.

The question of associating the Permian with the carboniferous provoked the most interesting discussion of the congress. Stur of Vienna, Lapparent, Blanford, and Prof. Newberry, spoke in favor of such union. Hughes, Topley, Nikitin, and a great many others spoke against it. Prof. Newberry, in the course of his remarks, s "his honored colleague, Prof. Hall, was opinion that the Permian did not exist in A and that his own studies confirmed this vie

M. Neumayr thought "the decision questions as this should not depend upo jority vote which would change in each and after each eloquent speaker" (referrin Lapparent's brilliant defence of the com proposition). This view was finally taken, congress adopted, with about fifteen di votes, the following proposition formulate Dewalque: —

"The congress, not wishing to pronou opinion on the scientific question, will le classification as it is."

After much debate, the threefold divisio triassic was agreed to, but without assign names. The division of the system int was adopted, but without specifying the n the divisions. It was agreed that each g might draw the upper horizon of the lia he thought best. It was agreed that the should be joined to the cretaceous. Th gence of views on this subject was so gr M. Capellini, then in the chair, cut short th question by asking for a vote of confidenc committee, which was unanimously given.

Finally the sevenfold division of the rocks in as many tints of red was carried opposition.

This completed the serious geological the congress, and it was then agreed to London in 1888. A committee, consi Hughes, Geikie, Blanford, and Topley, pointed to make the necessary arrangeme the congress adjourned.

During the course of the congress, a were given by Messrs. Gaudry on certain Newberry, on a new large Devonian fi America; Posepny, on the fluid condition earth's interior; Ochsenius (in German), origin of salt deposits; Neumayr, on the the 'Nomenclator palæontologicus' whic compiling (and which the congress voted lish under its auspices, and through the a a special committee consisting of MM. Zittel, and Neumayr, and one other who escaped the writer). M. Nikitin presented of middle and south-eastern Russia, inclu valley of the Volga; M. Vasseur exhibited of the map of France; and Dr. Frazer (on b Mr. McGee) presented an explanation of the employed by the director of the U. S. g survey.

The delegation which represented the States at the congress consisted of Prof.

Hall and Prof. J. S. Newberry, members of the original committee which suggested the congress; Prof. H. S. Williams, and Prof. Persifor Frazer, who were elected by the American association for the advancement of science at its Ann Arbor meeting. These four constituted the American committee selected by the A. A. A. S. Besides these, Prof. Brush was elected by this committee under the powers vested in it. Mr. J. F. Kemp (asst. to Prof. Newberry), Mr. H. B. Patton (student), and Mr. H. E. Miller (chemist), from America, also appeared on the roll of the congress. Mr. McGee, representing Major Powell and the U. S. geological survey, arrived after the session had commenced.

In all, 255 members were in attendance, of which 163 were from Germany, and the rest mainly divided between Italy (18), Austria-Hungary (16), Great Britain (11), France (10), United States (9), and Belgium and Russia (6 each).

A detailed report of the committee, giving the debates in part, has already been completed.

LOCALIZATION OF FUNCTIONS IN THE BRAIN.

HAPPY those who in the rapid revolutionizing of brain-physiology, which the last few years have brought about, have kept abreast of the current. For the new publications are so minute and rapid that, once left behind, there is no hope of catching up. The vivisectional results of Goltz, Ferrier, Munk, Luciani, and a host of others, with the rather rough polemics which have characterized the German writings on the subject, must have given to many the impression of an almost desperate field where no two experimenters could agree as to the facts, and no one, not himself an experimenter, could critically judge of the relative merits of the investigations published. The researches of Munk in particular, professor at the veterinary school in Berlin, seemed to be on such a vast scale, had such an imposing clearness, were set forth with such an air of *überlegenheit* over all comers, and above all presented such an exact correspondence of facts with theoretical requirements, that it was hard to know just what to think of them. Everyone's else researches sounded clumsy and immature in comparison. And yet their very absoluteness awakened suspicion. Munk seemed too clever, his neatness more French than German. Nature does not often yield so exactly balanced a sheet of accounts with our laboratories, especially those of physiology. Results are apt to be more conflicting, and vary more from one *versuchsthier* to another. And so in spite of Munk's apparent superiority, many lookers-on have secretly felt as if the ruder style of Goltz and others, and their vaguer conclusions, would prove to be more in the line of final truth.

Professor Christiani's little book strongly helps to corroborate this view. Munk is a strict localizer of functions. By his extirpations in dog's brains he thought he had mapped out the exact part of each occipital lobe which presides over the sensibility of each part of the retinal surface. He said that blindness, sensorial and intellectual, total and irreparable, follows complete ablation of these lobes; and when Herr Christiani in one of the memoirs republished in this volume, announced his observation that rabbits from which the cerebral hemispheres were entirely removed, would, nevertheless, steer clear of obstacles in their path as they loped about the room, Munk came down upon him with a tone so much resembling divine retribution that all bystanders must have thought it impossible for the younger investigator ever to show his face again. But this was reckoning without the resources of experimental physiology. Professor Christiani comes up smiling in the pages before us, and, we think, shows himself decidedly the better man of the two. Not only does it appear from Munk's subsequent confession that his first would-be repetitions of Christiani's experiments on rabbits were injudiciously performed, but we think we also see a decided obstinacy and lack of candor in Herr Munk's refusal to admit the injudiciousness. As well as a mere reader can judge, Christiani seems to have really proved that the avoidance of obstacles during locomotion is in rabbits a function which may be performed by the aid of visual centres *below* the hemispheres of the brain; in other words, that his rabbits were not really blind.

The latter half of the book is occupied by an historical survey of the localization of the function of vision, a survey of which the evident purpose is to show by a cumulation of evidence, how one-sided Herr Munk's observations, and how absolute his inferences, have been. This survey is to be recommended to all who would like to review this interesting chapter of physiology. It leaves naught to be desired in the way of learning, and its polemic tone is courteous. It shows an amount of evidence against any *exclusive* connection of vision with the occipital lobes, which, to our mind, is quite overwhelming when brought together in this way. It suggests, as Goltz does, that much of the blindness resulting from lesion of the occipital lobes may be due to an *interference* with lower visual centres spreading from the irritation of the wound. But, though breaking down

Zur physiologie des gehirns. By ARTHUR CHRISTIANI. Berlin, *Enslin*, 1885. 10+175 p., 2 pl. 8°.

the absolute form of Munk's localizations, Professor Christiani does little to put any other positive and definite conceptions in their place, and one may say as a last result, that he leaves the subject of division of labor in the brain as obscure as he found it. There are some other important and interesting experimental discoveries in the book, to which we lack space for reference. It may be added, in a general way, that the question of localization seems now in a far more hopeful state than ever before. The distinction of relative centres and absolute centres, introduced by Exner, in his statistical study of human brain lesions, bids fair to be a fruitful conception, if it can ever be intelligently worked out. A recent article by Exner in the *Biologisches centralblatt* (band v., hefte 1 und 2), takes a mediating position and tries to show that the facts reported by Goltz and Munk are far less at variance than the reporters themselves think. It is a very praiseworthy article, and should be read by all those who are interested in the subject of Professor Christiani's work.

GEOGRAPHICAL NOTES.

ADVICES from the Pacific coast afford some details in regard to the journey of Lieut. H. T. Allen and his companions, though the complete report is of course reserved for headquarters. There is a good deal of confusion of names, distances, and positions in the press reports, from which, however, we are able to gather that the party ascended the Copper or Atna River, and explored its northern and western branch to its source, a distance which, omitting irregularities of the stream, must be between two and three hundred miles. The Copper River had been explored by Serebrannikoff to a distance of some fifty miles from the mouth in 1848; and several prospectors have been on the river since the purchase of the territory by the United States, but no record, except in newspaper articles, has been kept of their wanderings. The branch explored by Lieutenant Allen and the eastern branch are about of equal size; the latter is believed to rise not far from the head of Lynn Canal. They found the river extremely rapid, with many cataracts, and having in some places a fall of seven feet to the mile. Its width is variable, sometimes several miles, including large islands; at others but a few hundred feet. There are many glaciers near it, and the active Wrangell volcano rises almost from the river. Remains of the mammoth were seen; the color of gold was found in the river-bed, and copper and silver ore brought back, the former from the range in which the river heads. A portage was made across this range to the sources of the Tananah, where there are a number of extensive lakes. The river was reached about 125 miles above the point to which it had been explored, and it and the Yukon were followed to the sea. Game was not very abundant, fish being the chief reliance of the Indians. No casualties occurred, the chief difficulty being to obtain labor, since the Indians were averse to work. Two miners and several Indians were with Lieutenant Allen's party, which found some difficulty in subsisting on the country. Great credit is due Lieutenant Allen and his companions, whose journey may be compared to that in which the celebrated Robert Campbell discovered the sources of the Yukon.

Lieutenant Cantwell's recent exploration of the Kowak River was made by a party consisting, beside the commander, of two seamen; C. H. Townsend, naturalist; an interpreter; and eight or ten Innuit. The river was entered July 2 with a steam launch and two canoes. At the rapids Townsend remained with the launch, the rest ascending in skin canoes. They reached with great difficulty a cañon some 300 feet deep and very narrow. The boats were hauled over a temporary bridge constructed of felled trees. Above the gorge the stream became very shallow. After great difficulty the source of the river was reached, consisting of four large lakes, of which the most important is in about north lat. 67°, west long. 153°. It is supposed to be about 520 miles from the mouth of the river.

Assistant engineer Samuel B. McLenegan, who accompanied Cantwell in his exploration of the Kowak in 1884, this year undertook a very difficult bit of exploration in a double bidarka or kayak, obtained at Unalashka. Owing to the difficulty of obtaining native assistance he was accompanied only by Seaman Nelson of the Corwin. They ascended the Noŭtak, also called the Nunatak or Inland River, which has been known for thirty years, but never explored. This river enters Hotham Inlet, westward from the Kowak, and about thirty miles north of the arctic circle. They entered the river July 2, and found almost from the first great difficulty in stemming the rapid current; at times they were compelled to track the canoe by a line from the bank, or wade in the shallows of the river-bed. Much of the region was mountainous. The river passed through numerous cañons, with sides rising high above the water, even reaching 1,000 feet in some places. The scenery was very grand. Indications of iron and copper ore were observed in many places. Two hundred and seventy-five miles, by the river, above its mouth, part of the provisions were cached, and the explorers lived on the country,

finding game plentiful. On the 30th of July a point was reached where canoe navigation ceased on account of shoal water, and the two men proceeded on foot. Near the head-waters, instead of mountains, there were elevated moorlands, with scanty vegetation and destitute of timber. The source of the branch ascended was found to be a small lake surrounded by snow-banks, and supposed to be about 400 miles from the coast. The natives, of whom about 250 live on the river, were friendly, and the return voyage was made without accident. The run down the river was very exciting owing to the numerous rapids and impediments. The party reported on board the Corwin August 27. The voyage, which was extremely creditable to those who took part in it, is noteworthy, as the party reached the highest latitude yet attained by white men in the interior of this part of Alaska. The report and charts which are being prepared for the department will doubtless fill a large part of the blank space which occupies the best maps of this area.

A letter from Mr. Henry D. Woolfe, who has been during the past year stationed at Cape Lisburne on the arctic coast north of Bering Strait, states that the winter there had been a mild one, February being the coldest month, with a minimum for the winter of — 45° F. There were many heavy southerly gales during December, January, and February. The range of hills in which the Noŭtak or Nunatak River rises was in a direction E. N. E. mag. only three days from the station. In February and March he travelled along the coast from Cape Lisburne to Hotham Inlet, and ascended the Noŭtak on the ice about thirty miles to a village of Innuit. Between the Corwin Lagoon and Cape Krusenstern a river falls into the sea, which he was informed was connected with the Noŭtak, running behind the hills which lie back of Shesholik village. Mr. Woolfe is preparing a map showing all the native settlements and even single huts temporarily occupied along the coast between Cape Krusenstern and Point Barrow. He had discovered several new coal veins, and, in fact, found a region about twenty miles square that was a continuous coal-field, the coal belonging geologically to the carboniferous age, and being easily got at, and of excellent quality. It has long been used for fuel by the whalers, and the Pacific whaling company are having it mined to supply their steam whaling vessels.

ASTRONOMICAL NOTES.

Small versus large telescopes.—Mr. Denning's crusade in favor of small telescopes seems to have come to a rather inglorious ending in the closing sentence of his letter (*Observ.*, '85, 305), which reads, "The efficacy of small instruments comes in where it is desirable to have that critical sharpness of the image resulting from a suitable blending of aperture and power with atmospheric conditions," whatever that may mean. The truth would seem to be, that very much of what observers with small telescopes call 'sharp definition' is merely the smoothing out of actual minute irregularities, or very slight unsteadiness, which limited aperture is powerless to separate or define, on account of the overlapping diffraction circles or bands, which necessarily constitute the image of every point or line. One matter, however, might with profit be further investigated, and that is, whether the larger cylinder and cone of rays from a large aperture materially increase the disturbance of the image when the seeing is bad. Perhaps the most amusing feature of the whole discussion is where Mr. Denning (*Observ.*, '85, 207) fails to grasp the sarcasm of Professor Hall's communication (*Observ.*, '85, 174), and takes it as written in sober earnest.

Comet 1885. III. (Brooks).—The comet found by Brooks on August 31 appears to have passed perihelion about three weeks before discovery. According to three independent sets of elements, perihelion passage occurred on August 10, the comet being then at a distance 0.75 from the sun (the earth's distance from the sun being unity). The nearest approach to the earth seems to have occurred about September 25. Even at its best, the comet seems to have been a very unsatisfactory object to the observer; and it can probably be seen now only in the more powerful telescopes. It is less than a third as bright as on September 5. The observations thus far published extend to about the middle of September, and the comet is generally described as round, faint, increasing a little in brightness toward the centre, without definite nucleus or tail, and some two or three minutes of arc in diameter. We should mention that Mr. A. A. Common, of Ealing, England, is reported to have discovered the comet independently on the evening of September 4.

New variable in Cygnus.—Mr. J. E. Gore announces (*Astr. nachr.*, 2683) that the red star Birmingham 587, south-following ρ Cygni, varies between 5.8 and 7.5 magnitudes, in a period of about 250 or 300 days, the last maximum having been in December, 1884. The star is Lal. 42153 and D.M. + 44°, 3877.

Common decimal unit of circular measure.—It seems that the recent somewhat sensational announcement (*Nature*, xxxii. 465) of a supposed rapid proper motion in Novæ Andromedæ arose from the failure of an English amateur to distin-

guish between seconds of arc and of time. Although an inexcusable blunder, yet it serves to emphasize anew the intolerable nuisance of this double unit, and makes us wish for the speedy coming of the day when all kinds of circular measure shall have a common convenient unit; when every watch and clock face, every graduated circle, and every logarithm-table of the trigonometric functions, shall be divided into decimals of the circumference.

Gould's Zone catalogue.—The Argentine government have presented the stereotype plates of this valuable catalogue to the Astronomische gesellschaft, with authority to use them for a new edition whenever it is needed.

NOTES AND NEWS.

THE National academy of sciences will hold its autumn session in the capitol at Albany, beginning November 10, at eleven o'clock. The session will probably continue three or four days.

— The Lowell free courses in the Teachers' school of science, under the auspices of the Boston society of natural history, will begin on November 7, with a series of lectures by Prof. A. Hyatt on the structure and habits of typical animals.

— Despatches from Paris, under date of Oct. 27, announce that at the meeting of the Academy of sciences, held that day, M. Pasteur furnished proof of his theory that inoculation was easily practicable, and had been successful in preventing hydrophobia. Dr. Vulpian gave additional proofs confirming the deductions of M. Pasteur.

— Mr. F. W. Putnam has been chosen Peabody professor of American archæology and ethnology under the Peabody trust at Harvard university.

— The October number of the Harvard university bulletin contains continuations of the very useful index to the maps in the London geographical society's publications, and a further instalment of the bibliography of the Kohl collection of early American maps.

— *Lippincott's magazine* for November contains a well-written article on the Peabody museum of archæology at Cambridge, by Ernest Ingersoll.

— Henshaw's list of the Coleoptera of America north of Mexico, just issued, includes 9,238 species. Crotch's check-list, published in 1874, contained 7,450 species. Previous to these came the lists published by Le Conte, and in 1880 Austin published a supplement to Crotch, bringing the number of nominal species up to 9,704, which recent studies have greatly reduced.

— The Johns Hopkins university *circular* for October is entirely devoted to the summer work of the Chesapeake zoölogical laboratory at Beaufort, N. C., and contains interesting summaries of investigations upon the embryology of a variety of invertebrate marine animals, and on the physiology of some of the lower vertebrates. An interesting 'Note on inheritance,' by the director, Dr. Brooks, is added, containing a rejoinder to some criticisms that have appeared on the author's work on 'Heredity,' together with a short letter from Fritz Müller, discussing the question of heredity among the Brazilian species of Melipona.

LONDON LETTER.

THE prospects of the Marine biological association are now beginning to shape themselves somewhat definitely. A suitable site for a laboratory has been obtained at Plymouth, and the building committee, which consists of the officers, together with Mr. John Evans and Mr. Spence Bate, will meet shortly to make a final decision upon the plans which they will recommend to the council. The subscription list has not received many additions of late; but it is hoped that further contributions may be obtained, when the public can form a better idea of the nature of the building and its uses than is the case at present. A grant of money will probably be given by the treasury toward the expenses of the station, provided that it is brought into relation with the Scotch fisheries board, the duties of the English fish inspectors being limited to the salmon fishery only.

A considerable amount of criticism has been excited in biological circles by the action of the government in abolishing the professorship of natural history at the Normal school of science, South Kensington. The chair has hitherto been filled by Professor Huxley, who has lately retired in consequence of ill health; and as the salary attached to it is greater than that of any similar post in England, it has always been regarded by the younger school of zoölogists as the highest object of their ambition. Now, however, this will be no longer possible. English zoölogical teachers are left without an official head, and the flow of promotion has received a sudden check. It had been generally thought that the chair would be given to Professor E. Ray Lankester, who is well known not only as a distinguished investigator, but also as a teacher of no ordinary power. His claims, however, have been altogether passed over. The professorship has been abolished, and a

lectureship, at a diminished salary, has been established in its place. This is filled by Professor Huxley's former assistant, who has long had entire charge of the laboratory teaching, and has just brought out an admirable atlas of elementary biology. It was certainly desirable that his merits should receive the recognition which they deserved. But this might surely have been effected without the infliction of a blow which will be felt in almost every zoölogical laboratory in the country.

The Prince of Wales has fixed Monday, November 9, for the official closing of the International inventions exhibition. Upwards of three and a quarter million visitors have thus far been admitted. A valuable series of reports, by experts, on the various classes of exhibits, is appearing in the *Journal of the Society of arts*, which has been from their commencement, the official record of these exhibitions. A scheme is on foot for forming, from this exhibition, a floating exhibition on board a large steamer, which is to visit the chief ports; and in this way the benefits of the exhibition may be extended.

Among the various agencies for creating an interest in the methods and results of scientific inquiry, on the part of artisans and persons of very limited means, the operations of the Gilchrist educational trust deserve notice. The founder, Dr. Gilchrist, a Scotch surgeon, left on an exceedingly open trust, for the benefit and advancement of scientific learning in any part of the world, the income of certain investments, which have since become very valuable. One of these was a piece of land now in Sydney, Australia, for which he paid $90, which was sold a few years ago by the trustees for $360,000. Part of the trust income is expended in scholarships, chiefly granted to students in Canada, Australia, India, etc., to enable them to study in England. Another portion is devoted to the delivery of courses of scientific lectures in English and Scotch towns, under local management, but subject to the condition that the charge for admission shall not exceed two cents. These lectures are specially addressed to large popular audiences, often comprising 2,000 persons or more. Ten such courses are now running in various towns, and the lecturers engaged in them are Dr. R. S. Ball (Royal astronomer for Ireland), Dr. Dallinger, Prof. W. C. Williamson, Dr. Andrew Wilson, and Mr. Wm. Lant Carpenter. A course usually consists of six lectures, one half on physical subjects, the other upon biological, and their aim is avowedly to awaken an interest in science. Usually the lecture halls are crowded to their utmost capacity. W.

London, October 13.

WASHINGTON LETTER.

The improvements on the arrangement for protecting the Washington monument from damage by lightning are now being made, and will probably be completed within a week. The disturbed portion of stone-work has been very neatly drawn back into its place, and secured by bolts from within. The changes which are being made, with the hope of avoiding all possible injury in the future, are essentially as follows: Around the lower part of the aluminium pyramid which terminates the shaft has been fitted a sort of collar, from which project eight pointed metallic rods, each about three inches in length. To the corners of this collar four copper rods, about one-half an inch in diameter, are secured, extending down the edges of the fifty-five-foot pyramidal apex. These four rods are joined together at a number of points along their length by horizontal strips of metal, each having a cross-section area nearly as great as that of the half-inch rod, but of different form, so as to fit closely into openings along the junctions of the various layers of masonry. All are securely joined to the corner or edge rods; and along both horizontal and edge rods metallic points, similar to those surrounding the base of the aluminium apex, will project at right angles to the rods, and at distances of four or five feet from each other. It will be seen that the great terminal pyramid will thus be covered with a sort of cage of metal rods, from which will project a large number of small metallic points. All of the metal thus placed upon the surface has been carefully plated with gold to prevent discoloration of the stone through the action of the weather on the copper.

The connection of this external cage with the internal conductor seems to be all that could be desired. To begin with, from the base of the small aluminium pyramid a copper rod or bolt, one and a half inches in diameter, extends to the base of the capstone, by means of which it is secured to the latter. From the extremity of this rod four rods of copper, each having a diameter of three-fourths of an inch, proceed downward, and, separating at a distance of a few feet from their upper ends, are led to the four middle piers of the iron structure which carries the elevator and the stairway. This structure extends through the whole height of the monument up to some distance beyond the five-hundred-foot level. It consists, in the main, of eight wrought-iron columns, four being six and one-half inches in diameter, and four seven and one-half, and all tied together through iron braces and stays. In addition to the electrical connection of the exterior cage through the aluminium apex, as above described, independent

connections of the corner or edge rods to the iron columns are made at several points lower down, by passing one-half and three-quarter inch copper rods through holes drilled in the stone-work of the pyramid. At the bottom the earth connection is made by four heavy copper rods, which project several feet into a well of moist sand, at the bottom of which water is always standing.

Owing to the unrivalled height of this monument, its protection from damage by lightning is a matter of scientific as well as of practical interest, and the efficiency of the plan now being carried out will doubtless be questioned in some quarters; but it is a problem which time alone can satisfactorily solve. Z.

Washington, D.C., Oct. 26.

BOSTON LETTER.

ALTHOUGH the removal of *Science* to New York is greatly regretted here, the many friends it has made in the place of its birth continue to express their great interest in its success, and their appreciation of the efforts made toward its constant improvement. Its weekly reception, too, on the very day of its publication in New York, makes a very favorable impression, since this was by no means the case when printed here; it lessens, to some degree, the regret at losing it as one of the scientific attractions of the community.

The publication of the 'Life of Agassiz' is most favorably commented on in our scientific circles. It awakens anew the enthusiasm toward our great naturalist which was always manifested in the most lively manner whenever he made a public appearance. We are all glad, moreover, to possess a clearer and fuller account of his university life, when he was laying the foundation of his remarkable career. The unity of his whole life, the persistency of his mental and moral characteristics, can here be traced as never before, while the successful outcome of his early aspirations lend a completeness to the picture, and are a source of inspiration to any reader.

No clearer case can be pointed out than his connection with Harvard, of the utmost importance to a university of securing men in its scientific posts who are not merely excellent teachers, but are also thorough and active investigators, imparting to their pupils their own ardor in scientific research. The band of students who flocked to his standard is scattered all over the country, most of them teachers in colleges, and everywhere leaders in scientific work and thought. No other such band of disciples in any science has ever appeared in our country; and his presence at Harvard raised the standard of its scientific department to a height of excellence and renown, as nothing else could have done.

It may not be known to all your readers that the designer of the Puritan has made his mark already in quite another field of science, being favorably known for many years as an entomologist. His memoirs on the anatomy of Lepidoptera and other orders of insects, and his minute technical knowledge of Diptera, easily won for him a place in our Academy of sciences. His friends in the scientific club here are very enthusiastic over his new success, and propose to give him a dinner in recognition of their appreciation of it, at which it is hoped that he will relate some of the points which have made the Puritan the fastest known yacht in the world. Yet they have some doubt whether he will consent even to this private honor; for, though the most genial companion in the world, Mr. Burgess is modest to a fault.

The bequest of the late Robert Treat Paine was mentioned in *Science* last July, when it was stated that Harvard college observatory would receive nearly three hundred thousand dollars, one half at once, the other on the death of his widow. This was particularly opportune, for the increased work of the observatory in later years had been due to an annual subscription raised by its friends for a limited period, then recently past. Unfortunately, it now transpires that the will is contested in the courts by the heirs-at-law, who claim that he "was not of sound and disposing mind and memory." Under the laws of Massachusetts, the costs of legal action of this sort are chargeable to the estate, so that there is danger that, even if the will is not broken, the amount finally received by the observatory may be somewhat diminished, and, in any event, delay must ensue; so that the observatory is now working on a sadly diminished income, for which even the zeal and ingenuity of the indefatigable director cannot wholly atone. Y.

Boston, Oct. 24.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Cruise of the Arethusa.

THE yacht Arethusa, having on board an expedition to Newfoundland, previously noticed in *Science*, returned September first to Annisquam, Mass., after a successful trip of three months.

The scientific party consisted of Prof. Alpheus Hyatt, curator Boston society natural history; Dr. E. G. Gardiner and Mr. George Barton, instructors in the Massachusetts institute of technology; Dr. Howard M. Buck, of Boston; Sidney R. Bartlett and C. L. Burlingham, students of the Institute of technology.

The weather while going and returning was not upon the whole favorable, but while on the coast of Newfoundland and Labrador, from June 17 to about

August 10, it was very fine, and greatly facilitated the work of the shore parties. The prevalence of high winds made opportunities for dredging exceptionally rare, and very little was accomplished in this direction. The shores proved, also, excessively barren; the pools were infrequent and not rich in species. From Cape Ray to St. John's Island, for the space of two hundred and fifty miles on the western coast of Newfoundland, the principal mountain ranges, whose general course is north-east-south-west, approach the sea more or less closely. They are so arranged that they present their ends to the sea on the south coast, and are seen more from the side on the west coast. From St. George's Bay to St. John's Island, on the western coast, they form a series of steep cliffs, cones, and domes, which also greatly enhance the beauty of the deep and branching fiords of Bay of Islands and Bonne Bay. The climate, vegetation, and lovely harbors, made the trip along this part of the route a series of delightful surprises.

The only population on the west coast consists of small settlements of fishermen, with very few persons of a higher grade Besides these permanent inhabitants, there are several fishing settlements of French, who come only for the summer. They still have fishing privileges on and off this coast, but are not allowed to erect permanent habitations. These rights and the islands of the St. Pierre group on the south coast, where their flag flies, are the remnants of the once extensive territories of the French nation on this continent.

Hotels, boarding-houses, and travelling accommodations, do not as yet exist. The steamer which runs from St. John's to Bonne Bay is so uncomfortable that only the hardiest males would be repaid for attempting to force a passage even in summer as far as Bonne Bay. The officers of this vessel were exceedingly polite and obliging, but the owners have sadly neglected their duty in all that relates to the steward's department.

Fossils were collected at various localities along the west coast from near Cape St. George to Cape Norman, the northernmost point of Newfoundland, and at the Atlantic entrance of the straits of Belle Isle. These fossils fairly represent the faunas of the formations called Quebec and Point Levis groups by the Canadian survey, and the Trenton and lower carboniferous of the Newfoundland survey.

The facilities for acquiring fine specimens of fossil cephalopods far exceeded the most sanguine anticipations. Several well preserved specimens of the imperfectly-known and curious, primitive form, Piloceras; fragments of orthoceratoids allied to Endoceras, which are more than two feet long and four inches in diameter at the living chambers; a number of large cyrtoceran shells, and a considerable number of more or less perfect, close-coiled and lituites-like Nautiloidea are among the principal acquisitions. The latter include all the species originally described by Billings from Newfoundland, and probably some new species.

It may be provisionally stated that Piloceras is a curved or cyrtoceran form of Endoceras, and that Actinoceras also had a curved shell in some species, which was not less than thirty inches in length.[1]

[1] This is a strong confirmation of the author's views that the same group of Nautiloidea and Ammonoidea may have straight, bent, or cyrtoceran, and even close-coiled shells.—*Science*, Nos. 52–53, 1884, and Proc. Am. assoc. adv. science, vol. 32.

Two fine specimens of the latter with very long, living chambers, were dug out near Point Rich.

The limestones of the Quebec group form a continuous and unbroken series of conformable strata, which are particularly well shown at Port au Port. The large numbers and prevalence of gasteropod shells of the genera Maclurea, Pleurotomaria and Murchisonia, fragments of Isotelus and Asaphus, and the abundance of Endoceras-like orthoceratoids and Actinoceras, together with transversely-ridged species like Orthoceras vertebrale, give the fauna of the uppermost of these limestones at Port au Port a Lower Silurian aspect. These resemblances, however, are counterbalanced by marked differences. Thus there is a comparative scarcity of Brachiopoda, and there are no massive corals which can be considered as having materially aided in the accumulation of the rocks. The presence of ancient forms like Archeocyathus and Calathium, which are probably sponges, and of Piloceras, and the comparative abundance of the coiled forms and partly-coiled Nautiloidea with open umbilici and cylindrical whorls, indicates a primitive assemblage of organisms more ancient than the Lower Silurian, and evidently introductory to that fauna.

At Port au Port, also, the actual contact of the Levis slates with limestones of Quebec was studied. These rocks contain Lingulae in abundance, and also trilobites, already described by Billings. It cannot be questioned that they lie above the limestones and are conformable, though having an entirely distinct fauna.

Above this lies the so-called Sillery conglomerates and sandstones, a series of unfossiliferous strata. As described by Richardson of the Canadian survey, and Murray and Howley of the Newfoundland survey, they are also comformable, but overlie the Levis slates.

A fault, already traced by Murray and Howley, separates the northern horizontal outcrop of the Sillery at Long Point, Port au Port, from Murray and Howley's Trenton limestones.

The fauna of these last is certainly like that of the Trenton of New York, but it has a decidedly Newfoundland facies, and its only visible contact is along the perpendicular fault above mentioned. It contains a great abundance of Bryozoa, Brachiopoda, and reef-building corals, which remind one constantly of the aspect of the Trenton fauna, and has altogether a more modern aspect than the Quebec faunas. It is not yet ascertained whether the Endoceratites found are true Endoceras, but fragments of an undoubted Gonioceras were collected in considerable numbers in the lower series of these rocks. It seems, therefore, very probable that Murray and Howley are correct in considering the strata at the end of Long Point as the equivalents not only of the Trenton proper, but also of the Black River and Bird's Eye faunas.

All of the rocks in this part of the island dip away from the mountains in a south-westerly direction, passing out of sight under the waters of the Gulf of St. Lawrence. Thus the outermost strata are, in a general way, more recent than those lying inland or nearer the mountains. The geological position of the Trenton at the end of Long Point, Port au Port, is not far out to sea, but the well-marked fault which occurs between it and the Sillery to the south, or the same narrow point, shows that it is a fragment of an overlying formation, which, having fallen to its

present level, has been preserved, together with the older rocks immediately adjoining.

The immediate contact of the Quebec limestones and underlying sandstones and quartzites was seen but not closely examined. There can, however, be but little doubt that the quartzites of Bonne Bay, on the east shore of the east arm, lie as described by Richardson and mapped by Murray, directly underneath the Quebec limestones, and are conformable. Whether they are the equivalents of the Potsdam or not, can only be determined from Richardson's observations and collections.

Collections were made at Anse au Loup and Amour Cove in the so-called Potsdam sandstones and limestones of the Canadian survey. The observations made at these points indicate a fauna quite distinct from those of any of the limestones or slates of the west coast of Newfoundland. The absence of Cephalopoda and the prevalence of primitive forms of Archeocyathus show the rocks to be probably older than those of the Quebec group at Port au Choix and other localities. The primitive sponges, or Archeocyathi, have here replaced corals completely, and may be described as reef-builders, since numerous hummocks and masses and parts of the strata are formed entirely of their remains. Immediately below these limestones, and conformably with them, lie the red sandstones, several layers of which are perforated with Scolithus burrows.

The geological evidence brought forward by Sir William Logan in the report of Canadian geological survey, 1863, to prove that the straits of Belle Isle have been partly formed by a synclinal valley, appears to us to be very defective. It is more in accord with the evidence to consider that the whole of northern Newfoundland was once much more elevated, and has been sunk by faulting until at the straits the Quebec has been brought down to the same level as the red sandstones of the opposite Labrador shore. The origin of the straits would in that case be considered as due to the changes of level produced by one or more of the same great series of parallel faults already traced by Richardson, Murray and Howley along the west coast. These run parallel with the axis of the straits, and seem to account fully for all the phenomena.

Observations were made upon the raised beaches and terraces which occur along the shores of Newfoundland and Labrador; and here, as well as at Anticosti and the Mingan islands, the marks of the recent elevation of the land are abundant.

Alpheus Hyatt.

An archeologist in trouble.

I am writing a book on American archeology, and as I cannot reconcile the accounts that are given of some of the most noted earthworks of the Mississippi valley, I naturally turn to you for help. Thus, for instance, I find that, according to one authority, Cahokia mound covers an area of fifteen acres; another puts it at twelve; whilst a third is content with six. All these gentlemen were practical explorers, and as they took the measurements 'carefully,' some of them even with mathematical instruments, there can, of course, be no mistake in the figures. In regard to the Serpent mound in Adams county, Ohio, there is a similar state of affairs. One practical explorer, who is nothing if not thorough, tells us that it is 1,415 feet long; another says it is 1,116; whilst a third, too wise to commit himself to any precise figures, merely says that, if extended, it would not be less than one thousand. To any but a practical explorer, these discrepancies may seem large, and, no doubt, they will deter a mere historical student from using these figures in any statement that aims at accuracy; but in reality they are not of much importance, since it is possible, by a judicious use of the system of averages, to arrive at conclusions that are certainly as near the truth as are most of the original measurements. One thing, however, does bother me, and that is the 'frog' which a recent explorer has discovered in front of the so-called 'egg' that lies between the serpent's jaws. It is 61 feet long, exclusive of the hind-legs, and is said to be in high relief (three feet); though another practical explorer, who visited the same work at about the same time, saw nothing of a frog, either jumping or sitting still, but does speak of a cow-path which may enclose an area of about that size. Now, Mr. Editor, what am I to do? I cannot go out there myself and 'step off' these distances; and if I did, some long-legged fellow would be sure to come along with *his* pair of mathematical instruments, and prove that my measurements were all wrong. Besides, I don't intend to give up that frog—it adds too much to the picture I am having prepared—and yet, I do not see how I am to average it so as to keep my measurements accurate.

R. R.

The spectrum of γ Cassiopeiæ.

Using a high dispersion, and the same precaution with regard to the eye as described upon a former occasion, in addition to the hydrogen lines, there are seen in the spectrumof γ Cassiopeiæ two lines and a dark space between C and D_3, five bright lines and three dark ones between D_3 and H_β, one bright line between H_β and H_γ, and perhaps another between H_γ and H_δ, with a dark space near H_δ. Changing the scale readings of these lines into wave-lengths, we obtain practically, with one exception, the same values as those of the bright lines observed in a solar protuberance in a total eclipse.

These lines apparently do not necessarily all appear at once, and afford an excellent field for study.

O. T. S.

New Haven, Oct. 21.

The care of pamphlets.

Mr. Goode asks, in *Science* of October 16, for the experience of others in regard to the care of pamphlets in scientific libraries. I give below a quotation from the publications of the Washburn observatory, vol. ii., which describes my plan, which was originally described in the *Library journal* for June, 1880.

"The pamphlets are kept in large drawers immediately below the book-shelves, and a drawer is devoted to a subject. As soon as a pamphlet is received, it is catalogued under its author's name, and placed in the drawer devoted to its subject. All the pamphlets on a given subject can therefore be at once consulted in one place; and all the works of a given author are to be found together in the card catalogue. I have used this plan for keeping pamphlets for [thirteen] years, in my own library, in the library of the U. S. naval observatory, and here, and I consider it to be an entirely satisfactory solution of the

ne problem of how to treat pamphlets in
al libraries." EDWARD S. HOLDEN.
n observatory, Oct. 19.

ttempt to photograph the corona.

p of the pen in my communication on this
the last number of *Science*, I gave the
to two previous letters as April 29 and
These should read May 29 and May 15.
graphical error I am made to refer the ob-
on the light of the corona to Prof. S. P.
The observations were made by his
rof. John W. Langley.
ng to his observations, as we have already
nce, August 14), the light of the corona
f the sun's disk is six times that of the full
ich, according to my observations, would
tieth that of our atmosphere in this vicin-
essor Bonney states, (The sun, p. 229.) that
y of only one sixty-fourth would be suffi-
ender the planets visible. Therefore, even
nospheres of Mercury and Venus produced
effect at all, the facts would still sustain
Langley's observations.

WM. H. PICKERING.

ecent Proceedings of Societies.

hilosophical society, Washington.

.—Mr. H. A. Hazen read a paper on con-
ygrometers and sling psychrometers. As
y to the paper proper, Mr. Hazen gave the
some interesting experiments which he had
a view of determining the most desirable
between the lines upon the stem of a ther-
in order that tenths of degrees may be esti-
th the greatest accuracy. He had made a
ble number of trials, in which he had first
the fractions, and afterwards measured
he use of a vernier. The results seemed to
hat there was a length of division on which
ation of tenths might be made with greater
than on one either longer or shorter. Mr.
l not consider, however, that his experi-
re sufficiently numerous to enable him to
this with certainty. On directly address-
lf to the subject of his paper, he called
to the various forms of Regnault's condens-
meter, which had appeared from time to
fly discussing the advantages and disad-
of each. He spoke of the numerous
which have been devised for ventilating the
eter, and expressed his belief that the form
the 'sling' was the best of all. Experi-
de by using both of these instruments for
se of determining the value of the constant
common psychrometric formula were de-
nd the effect of elevation was considered.
dendenhall exhibited one of Sir Wm. Thom-
-range voltmeters, which had been recently
by the chief signal officer. A small
of soft iron hangs upon the short arm
dex lever, which is so balanced as to
ically in indifferent equilibrium. The
surrounded, without contact, by a coil
so wound that the strength of the field
by the passage of a current increases
lower to the upper end of the coil. As the
he soft iron is proportional to rate of the
change of the square of the strength of field, and as this rate diminishes from the lower to the upper end of the coil, the force exerted on the cylinder will depend at once on the current strength and on its position in the coil. By hanging a small non-magnetizable weight to the iron by means of a hook projecting from the lower end, this force is made to be constant when equilibrium exists, so that when the current strength varies, the position of the iron cylinder changes, and this position is read off on a scale at the extremity of the long arm of the lever. The great merits of the instrument are its constancy and the ease with which it may be adapted to the measurement of potentials differing greatly in magnitude.— Mr. Mendenhall also made some remarks upon instruments and measurements of the so-called re-action time, originating in the exhibition of these instruments by Dr. Matthews at a previous meeting of the society. He referred to a paper upon the subject, which he had published in the *American journal of science*, in 1871, in which instruments and methods are described identical in many respects with those recently exhibited. Results were given, showing the time occupied in responding to a signal, which was a flash of light, the appearance of a card, a sound, or a blow upon the hand or head, and also the time consumed in the simplest processes of reasoning. These times were, in general, shorter than those recently obtained by Dr. Matthews, but differences in the manner of conducting the experiment will doubtless account for this.—Mr. Harkness discussed the flexure of transit instruments. He pointed out its dependence on the form of the instrument, and also that its amount might be expressed as the sum of two different functions of the zenith distance. The nature of one of these functions can be readily ascertained; but unfortunately that of the other is unknown, and, in a general sense, impossible to determine. For certain classes of instruments it might be ascertained by the assumption of accuracy in tables of star positions, but Mr. Harkness declared that he knew of no way by means of which the problem could be completely solved for the astronomical observatory. Discussion of this paper was prevented by the operation of a rule of the society, in obedience to which it closes its session promptly at ten o'clock. In a general way, it cannot be denied that a strict compliance with this rule has many advantages. A visitor to the society may be certain that he will not be obliged to wait for more than a minute or two after eight for its beginning, and, however uninteresting to him the dissertations to which he listens may be, he may console himself by the reflection that a limit is set to their duration.

Academy of natural sciences, Philadelphia.

Oct. 20.—A communication was read from Mr. W. N. Lockington on the causes of elevation and depression of the earth's surface, with special regard to the setting of loosely compacted sediments by pressure of superincumbent beds. Some have supposed that the great beds of ice which encumber the poles bear down the surface rocks of the region by their weight. It is, of course, possible that a downward movement of the earth's crust may be caused by strata piled upon it; but as the earth's contraction is a sufficient cause for all such movements, it is useless to postulate other causes. The extreme of possible compactness, however, is reached in the sediments themselves by the

pressure of their own bulk. When leaves, stumps of trees, etc., are found in a delta several feet below the sea level, subsidence by a downward movement of the earth's crust is usually invoked as a cause. It is forgotten that the weight of the upper strata of the delta has consolidated the lower, and gradually pressed them down. We know that a dirt bed in the older strata is but a line, while existing dirt beds are many inches or even feet in thickness. Sand becomes sandstone by pressure, but a hundred feet of sand will by no means form a hundred feet of sandstone. The alternations between fresh water and marine strata, the changes from land to shallow lake or sea, which marked the age of the coal-measures and caused the production of coal, need not have been, and probably were not, caused by the alternate rising and sinking of the actual crust of the earth. It is far more likely that they were produced by the settlement or consolidation of the strata themselves. Regularity of settlement would depend on regularity of deposition, which was impossible from the nature of the case. The deposition of vegetable material and the formation of coal were dwelt upon.——Prof. Heilprin remarked that geologists regarded the alternation of coal and dirt beds as indicating recurrent periods of stability, rather than alternating depression and elevation. The stability of the ocean bed and the formation of deltas were considered.——Mr. Jos. Willcox described the effects of glacial action as observed by him north of the St. Lawrence. The farther north we proceed, the less soil would be found on the rocks, depending on the lessened amount of moraine deposited by the glacier as it retreated toward the pole. The scorings on the rocks in the region visited by him were from the northeast to the southwest. He believed that the oldest or Laurentian rocks were at one time covered with sedimentary deposits which had been worn away by glacial action. In some places patches of such deposits containing fossils were yet to be found.——Prof. Heilprin believed that the truth was yet to be ascertained regarding the direction of glacial movement in Labrador. He was inclined to believe that glacial action started below the great circumpolar ice-sheet, and proceeded both south and north from the point of departure. He referred to his communications made some years ago, in which he objected to the belief that glacial action, as we know it, was owing to movements of a large body of ice from the north pole. The results of the most recent arctic investigations on the condensation of moisture and the existence of a cloud limit were given.

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RIDAY, OCTOBER 30, 1885.

CHUSETTS LABOR STATISTICS.

eenth annual report of the Massachusetts abor statistics offers a good example of n method of treating social questions. establish the conduct of the common- ward the laboring class on facts and wn conclusions, not on theories and is. It is perhaps the most typical fact dern aspect of the state toward the an, that there exist bureaus of labor

painstaking piece of work is the tabula- Vages and prices' from 1752 to 1860 in y. The tables give (1) the price for each e staple articles, (2) the price of these om year to year, and (3) a convenient of the changes in prices by periods of years. The value of these tables must gely on their great usefulness to future is direction. They form the text from te a various number of lessons may be

lustrial history of the country may be ll into three periods.

early industrial period, previous to . This period serves as a background h future prosperity stands out the more t is a period of hand labor; of few in- of no specialization—each artisan going he whole series of processes of his craft; money, so that barter was a great factor chanism of exchange; with little educa- e workingman, and a more absolute con- s welfare in the hands of the employer, eldom took an undue advantage of his

period of transition (1815–1830), charac- a gradual dissolution of the old and a doption of the new; from which finally

present period. The first great fact mps this period is the development of . New forces were employed and labor atural products were adapted to serve nts, and waste utilized. From 1841 to 45, ts for inventions were issued; in 1856–60, n 1855 an annual product of one million 1875 of three million), was made by the terest of Massachusetts, which thirty years before was mere waste caoutchouc gum. Specialization completely transformed the methods of labor. Each man makes one thing alone; by this means his share of the amount produced is enormously increased. In 1855 each operator in a shoe factory (under the old *régime*) produced 455 pairs of shoes; in 1875, 1205 pairs; while the average wages have risen from $205 per year to $397, and the actual time of employment has decreased 12 per cent. The introduction of machinery utilizes ignorant labor, and does not create it, as is often supposed. The lowest industrial class is thus raised in the social scale. The daughters of American farmers and mechanics were formerly the operators. Now skilled labor is not required. Accordingly their places are taken by a more ignorant class, while they move upward to higher callings, in which their entire mode of life is better than that of their predecessors.

A second great difference between the present period and its forerunners, is the change in the status of the laborer before the law. The government now limits the hours of work, prevents the employment of minors, abolishes imprisonment for debt, exempts the workman's tools from attachment, provides fire-escapes, authorizes co-operative associations, extends the benefits of free education, and much besides. The "difference in scale of living between the employer class and the laborer of the early period was far less than that between the workman of to-day and his predecessor." The tables tell the same story. The general tendency, broken only by temporary fluctuations, has been toward a rise in wages. The workingman of to-day is paid better, has more time to himself, and, in many cases, has even an increasing share of the net product of his labor. Prices, however, have advanced, and the final question is, have the wages increased more than the prices? The general increase in the wages, as shown by comparing the periods ending 1830 and 1860, is 52%, while the increase in prices averages 13%. Since 1860 the Massachusetts workmen may be said to have gained a 'pecuniary betterment' of over 10%.

In the last paragraph we reached the true test of the welfare of the workman: the relation between wages and prices. To this question, the essay on the 'comparative wages and prices' in Massachusetts and Great Britain, from 1860–83, is a valuable contribution. This essay is a condensation of three previous reports by the labor bureau,

and gives the whole matter in a concise and useful shape.

In the first investigation 24 industries were compared; and the average of different modes of computation leads to the result that, in general, wages are 62% higher in Massachusetts than in Great Britain. In those cases where pay-rolls could be compared, the average weekly pay was $10.82 in Massachusetts, and $5.48 in Great Britain. We must remember, however, that the number of working hours is 12% greater in Massachusetts. The average wages per hour show a gain of 71% in favor of Massachusetts. Women's wages, as also those of young persons and children, show a gain of 59% in favor of Massachusetts. The next investigation covered 90 industries, and considers the wages of at least 1,250,000 of employés. The wages in Massachusetts are 77% higher than in Great Britain. Besides wages have increased since 1860 in Massachusetts by 28%, in Great Britain by 10% since 1872.

The other side of the question is represented by the cost of living. Our sources of information are prices and workingmen's budgets of expenditure. Prices are higher in Massachusetts (for everything except provisions) on an average of 43%. The average family in Great Britain is slightly larger, but a slightly larger proportion of the family are at work, thus making a direct comparison with the Massachusetts family perfectly fair. In Massachusetts the earnings per family are 55% higher than in Great Britain; the former saves 6%, and the latter 2%, of its income. The expenditures for 1883 of the two families are $754 and $508. If we consider the articles of expenditure, we shall find a remarkable harmony with an economic law demonstrated by Dr. Engel (Royal statistician at Berlin). This law says, 1. the greater the income, the smaller the relative percentage of outlay for subsistence; 2. the outlay for clothing remains uniform, as also; 3. does that for lodging, rent, fuel, light; 4. the outlay for 'sundries' becomes greater as the income increases. The agreement between the calculated and actual values for each item of the expense is very close, the average deviation being less than 3%. The table further teaches that the prices of articles entering into the cost of living were 17% higher in Massachusetts in 1883; of this 11% is due to higher rents in Massachusetts, leaving 6% as indicative of the higher cost of living in Massachusetts. As a final conclusion we have that the standard of living of Massachusetts workingmen to that of the workingmen of Great Britain is as 1.42 to 1. That is, while the cost of living is higher, the wages are still so much higher than those in Great Britain as to leave a margin for better living and even greater saving.

Another portion of the volume deals with the problem of Sunday labor. The questions are: Has the Sabbath become a necessary element of modern industry, and is its abolition connected with serious evils or not? The departments in which Sunday labor is done are considered one. By far the greatest share of Sunday labor is done in connection with railroading. The first roads began without Sunday labor, but street and steam railways alike were forced to introduce labor by public demand. The trains are run for convenience rather than for profit. While employés generally declare that they would rather have the day of leisure than the additional pay, still the usual effects of overwork seldom appear. The important consideration is this: Sunday labor is not productive labor, but is labor for personal service, and such occupations do not call for constant exertion. If the weaver had to stand at the loom for seven days of the week, he would probably break down; but the car-conductor can work without physical deterioration. The proportion of Sunday laborers to the laboring community is probably larger than one would suppose, 15% of working females and 11% of males doing labor on that day.

THE ASCENT OF POPOCATAPETL

During the conquest of Mexico by Cortez one of his followers ascended this volcano to obtain sulphur with which to renew their exhausted supply of powder. The ascension of Popocatapetl, compared with that of other great mountains of the world, presents no unusual difficulties. In the course of the present century, many persons have accomplished it with entire safety, especially since the attention of the commercial world has been called to the great value of the sulphur deposits there.

The ascent is always undertaken from the west side of the mountain, starting from the village of Amecameca, which lies on the railroad from Mexico to Morelos. From here a horseback ride of three or four hours brings the traveller to the rancho Tlamacas, just below the snow-line. From this point the ascent is continued on foot. Each party is provided with alpenstocks, and with primitive sandals called *guaraches*, drawn over the boots to prevent slipping. A peon goes ahead and hews steps in the hard-frozen snow, and the others follow in Indian file, pausing every few steps and then to rest, as the exertion in the extremely rarefied atmosphere is very exhausting.

After the summit is reached, the view

[1] Condensed from an article by Carlos von Gagern in *Deutsche rundschau für geographie und statistik*.

weather is clear, amply compensates for all the difficulties of the ascent. At the feet of the spectator lies spread out like a map the beautiful plateau of Anahuac, over eighty miles long, with its four lakes, and more than 200 cities, villages and haciendas, including Mexico the capital, Puebla, Cholula, Atlixco and Tlaxcala, surrounded by snow-covered mountains, among which rise the peaks of Ixtaccihuatl,[5] only eight miles distant, Malinche, and farther toward the east, Orizaba.

The view of the interior of the crater is always completely obscured by the sulphur vapor, which constantly rises from the openings in the bottom, called *respiraderos*. It is at first of a greenish color, then condenses and falls in yellow drops, and finally forms into beautiful crystals. The edge of the crater is composed of immense blocks of porphyry and basalt. To descend into the crater, one follows a path leading downwards from the summit among ice-covered rocks, till a huge block of basalt is reached, which serves as a support for the primitive machine, called *malacate*, which is used here, as in most of the mines of Mexico, for the perpendicular descent of the remaining distance. A strong beam projects a few feet horizontally over the abyss; over a pulley in the end runs a long rope with a loop in the lower end. The person wishing to descend stands in the loop, holds the rope in one hand, and with the other manages a stick, to protect himself from injury by swinging against the rocks. Two peons let the rope run slowly out over the pulley, and in this way the descent is accomplished. The rope is over 250 feet long, and the descent occupies ten or fifteen minutes.

The crater has the form of a funnel. The bottom is composed of scoriæ, which glitter with various colors, and among which are the *respiraderos*. In one place is a stone so large that a man can stand upon it, which rises and falls as it feels the effect of the subterranean vapors. At the lowest point is a lake, the water of which has a sulphurous and also somewhat acid taste.

The descent of the mountain is, of course, very much easier and quicker than the ascent; that of the snow-cone especially is accomplished in a very summary manner, familiar enough to a New Englander, to be sure, but rather startling in its novelty to inhabitants of the southern countries. An Indian sits on the forward end of a mat, holding a stick upright between his legs; the traveller sits behind, clinging to the guide with hands and legs, and in less time than fifteen minutes the distance is traversed, which in the ascent occupied three or four hours.

According to the latest measurements, the height of Popocatapetl is 17,809 feet above the sea-level. The crater is about 2½ miles in circuit, and has a depth of 1,000 feet. Since the mountain has given out sulphurous vapors for centuries, and at the present time something like a ton of sulphur is deposited daily, the amount of the mineral existing there is almost beyond estimation. It would hardly be an exaggeration to say that the upper part of the mountain is an immense block of sulphur, enclosed in a shell of rock a few yards thick.

Three qualities of sulphur are obtained by the operations here. The best is almost chemically pure, obtained at the *respiraderos*, whence it issues in a liquid state and hardens as it cools. The other two qualities are known as rich and poor sulphur-ore. The former yields from 82 to 87 per cent of pure sulphur, the latter about 50.

The process used for the purification of the sulphur is that of Michel, with the apparatus improved by Lamy. The distillation takes place in six large cast-iron kettles, or half-cylinders, which take the place of retorts, and a large brick chamber which serves as the receiver.

Since the sulphur of Popocatapetl is much superior to the Sicilian, it is in greater demand in the American markets. The works at Tlamacas have control of enough water and fuel to increase their productiveness considerably. This would be in every respect advantageous; aside from the consumption of Mexico, the United States use 200,000 tons annually, and even if every ton were sold 20 per cent below the usual price, there would still be, after allowing for freight and all other expenses, a clear profit of two dollars a ton. The expenses of production are very small. The workmen receive only about 75 cents per *arroba* (25 pounds), although their work is laborious, dangerous on account of the constantly falling rocks, and from breathing the sulphurous vapors very deleterious to the health, causing in a short time, among other inconvenience, the falling out of the teeth.

The principal source of the world's supply of sulphur at present is Sicily, which produces four-fifths of that consumed. The deposits of Popocatapetl are greater than those of Sicily, and, as already stated, of better quality. It seems incredible that they have not been more thoroughly worked, especially as this sulphur can be brought to market 25 per cent cheaper than the Sicilian, at least in the United States.

A plan is now on foot to lead a tunnel through the wall of the crater directly to the sulphur deposits, and connect its mouth by a narrow-gauge railroad with Amecameca, which is on one

of the main lines of the country. The capital is forthcoming, and it is quite likely that in a few years this mountain, which is of such great interest in geologic, topographic, and artistic respects, will have acquired an almost incalculable industrial importance.

NATURAL ENEMIES OF OYSTERS.

Man in former times, and even at present in some localities, might be classed with the enemies of the oyster. But now, when he is introducing artificial means for their multiplication, instead of an enemy he becomes their protector. There are animals, harmless-looking and small, which do far more damage to this delicious shell-fish than man, and that, too, without giving anything in return. The many which are destroyed by human agency become few when compared to those killed by their smaller foes.

The oyster, although protected by a very hard shell that can be closed almost hermetically, is, on the whole, rather poorly defended, for there he lies right on the open bottom, exposed to everything that may chance to come along, without any power to move away and crawl into some crevice, but destined to remain motionless while attacked. Two kinds of animals do the most damage: one the common star-fish (Asterias Forbesii), the other a univalve spiral shell-fish, called by oystermen the 'drill' (Eurosalpinx cinerea).

A star-fish approaches its victim, slowly crawls upon it, and then bends its five arms around the shell. The mouth of a star fish is so small that an oyster a quarter of an inch long could not be taken into it. So what does it do, when its arms are encircled around the large oyster, but begin to project its stomach out of its mouth and surround the oyster with its stomach entirely outside of the body. Then the oyster gradually opens its shell, leaving the star-fish to do as it pleases. After a while the star-fish moves off, and we see that a large part of the oyster is gone. When the stomach is first protruded a liquid is excreted which seems to have the power of either killing or weakening the oyster. Just as soon as the shells are open digestion is begun by the star-fish, and after a short time the hunger of the star-fish is satisfied and the oyster is dead. Before long the star-fish feels like another meal, and he attacks another oyster, leaving the old one as prey to small crabs and shrimp. And so it goes on day after day, thousands operating in the same manner. At times they come in immense swarms from deeper water, in a single night entirely destroying a large bed. In brackish water they do not flourish, but in the almost pure ocean water found in some oyster-raising districts the destruction is immense, and there is no remedy.

If some shell-fish for which the star-fish have a preference could be introduced among the oysters, perhaps the devastation might be partially checked. Oystermen formerly had the stupid habit of tearing every star-fish that happened to come in their way into pieces, throwing the fragments overboard. They were not aware that each arm had the power of reproducing the remaining four arms and becoming a perfect star, so that each time one was torn into two or three pieces, two or three new individuals were formed.

The other enemy, the so-called 'drill,' is well named, for its peculiar operations are based upon its boring or drilling powers. Although seldom an inch long, it can bore a hole through the hard shell of an oyster with surprising speed. The hole is always smooth and about in the same place, a spot covering a vital part being the point attacked. Similar 'drills' operate on other species of shell-fish, and their deadly marks can be seen on the valves of the shells which are washed upon our beaches. In any collection of shells, and on any beach, numerous examples of the neatly-drilled hole can be found.

In the soft animal part of the 'drill' there is a little tube-like proboscis which encloses another proboscis. Over the end of the latter there runs a little ribbon which is covered with teeth. This ribbon, or odontophore, is attached at each end on the two opposite sides of the inner proboscis. By means of muscles at the base of each end of the ribbon it may be pulled back and forth over the end of the snout, with the teeth projecting outward. When the oyster is to be attacked, the end of the snout is pressed against that part of the shell to be bored, and the muscles begin to work the toothed strap. The teeth rasp away at the shell, each time removing particles of calcareous matter until a hole is bored. Then the rasp acts upon the flesh inside, and as the meat is removed it is drawn to the mouth and eaten.

The 'drill,' after eating a meal, leaves its victim, and later attacks another. By the time it has finished its meal the oyster is dead, and its shell flies open, leaving the rest to crabs and shrimp. Filing away upon the hard shell wears the teeth away rapidly, but this is remedied by nature, for one end of the strap is gradually absorbed, while from the other end a new supply of toothed ribbon is being formed. So, on one side of the proboscis, there are fresh unused teeth; on the other side, old worn ones; and on the end, teeth just being worn; and the whole gradually moving away to one end, to be absorbed while other fresh ones are being formed.

Ralph S. Tarr.

THE ACTION OF COLD ON MICROPHYTES.[1]

PROFESSOR MCKENDRICK, of Glasgow, gave at the recent meeting of the British association an interesting account of the methods of trying to destroy small organisms like bacteria, not as is commonly done by heat, but by cold. It is known that by means of Coleman's cooling machine meat may be kept from putrefying for a considerable time, but in attempting to sterilize a putrescible solution by means of cold, it was found that, though in some cases putrescence was delayed, in no case were the organisms completely destroyed. Organic fluids were exposed to temperatures more than 120° below 0° F., but on thawing they were found to contain living organisms still. Thus the hope of preserving putrescible matter by means of cold—an important economical result—is, so far as investigation yet goes, destroyed. The organisms under cold seem to be in a nearly solid state, though we cannot call it a chrystalline state. In a paste solution the water is chrystallized under cold, the paste remaining spongy. Possibly cold may separate from these minute organisms the water they contain, and this water is again absorbed on thawing. Meat under cold becomes very friable, while yet minute fragments of it show the same microscopic constitution of muscle. It is well known that frogs have been found in blocks of ice and been revived. Frogs have been frozen at 20° F. in about half an hour. On thawing slowly, the animal, in two instances, completely recovered. When it was frozen for longer than half an hour it did not recover; but, though reflex action was gone, there remained some irritability both in nerves and muscles. It was found also that certain vital functions may be arrested by cold, and thus conceivably higher organisms may be kept vitally inert for an indefinite time. Experiments were also tried on warm-blooded animals. A rabbit subjected to a temperature 100° below 0° F. recovered. No temperature lower than 73° below 0° F. has been obtained in free atmosphere.

PRELIMINARY REPORT OF THE COMMISSION APPOINTED TO REPORT ON THE SPANISH EARTHQUAKES.

THE commission appointed by the Spanish government to investigate the Andalusian earthquake of December 25, 1884, has made a preliminary report of its labors and conclusions up to March 7, 1885 (*Terremotos de Andalucía*, Madrid, 1885, 107 p.). This report is based upon a personal examination, which the members of the commission made of the region affected, and upon some thousands of answers received in response to a series of interrogations which were widely distributed. A more detailed discussion of their work is to follow at a later date. This report, however, deals quite fully with the matter in hand, and states conclusions which, although often only negative, are yet of considerable interest. We must be content with presenting here a brief *résumé* of its contents.

Beginning with a statement in seven pages of the theories proposed by various writers to account for earthquakes, classifying them as volcanic or non-volcanic, and attributing them to the internal heat of the earth, to the presence of vapors of high tension, or to the solution of the rocks by subterranean waters; it proceeds to give in seven pages more a description of the orography and hydrography of the two provinces of Granada and Malaga, and then devotes twenty-one pages to the geology of the same district, describing in detail the rock formation, with the location and direction of its principal fault lines.

Coming to the present occasion, a brief discussion of the times observed at different places leads only to the conclusion that the origin is to be sought to the west of Granada and east of Malaga, any exact result being vitiated by the uncertainty of the time data; this being due to the lack of good clocks and to the fact that, in places where much damage occurred, the attention of the inhabitants was pretty thoroughly occupied with caring for their own safety. The area affected is described as limited toward the north by Madrid and Segovia, toward the west by Cáceres and Huelva, toward the east by Valencia and Murcia, and on the south by the Mediterranean; but the tremor of the earth was also indicated by instruments even so far distant as Rome and Brussels. Examination of the direction of the cracks in the ground and in buildings, as well as of the curves of intensity, estimated according to the Rossi-Forel scale, leads to the conclusion that the focus is to be found in the valley of Zafarraya, where the greatest damage was caused.

The latter half of the report is mostly occupied with the phenomena preceding, accompanying, and following the earthquake, such as, changes in the course of streams, perturbations of magnetic apparatus, barometric depression preceding the shock, subterranean noises, dynamic effects, etc. In estimating the amount of damage done, the number of buildings injured in the two provinces of Granada and Malaga is stated as 17,178, of which number 4,399 are classed as totally destroyed. The injured persons were: 745 dead, 1,485 wounded. In discussing the causes of this earthquake, the commission accepts the Italian

[1] From *Nature*.

theories, attributing the earthquake to the tension of vapor of water in the subjacent strata. The valley of Zafarraya, indicated above as the probable focus, is a locality where much water gathers and easily penetrates beneath the surface, and to the vapor of high tension produced from the water here collected in deep-lying strata are attributed the forces which gave rise to the present earthquake. It is assumed that in general the lines of seismic propagation, following crevices in the strata beneath the surface, will accord with the direction of the surface water courses. On this idea, the principal radiant lines from Zafarraya were along the rivers Marchau and Genil; a view which is regarded as confirmed by the phenomena in the Sierras Tejeda, Marchamonas, and Eumedio, where large crevasses occurred parallel to the direction here indicated. In the province of Malaga the principal seismic effects were found in the vicinity of Periana, adjoining the district designated as the focus, but on the other side of the sierra, which separates the two provinces, and here the principal radiant line followed the course of the river Velez.

Theoretical considerations suggesting that the area affected should approximate in form to an ellipse, this is found to agree with the observations; but the data at hand do not suffice for any exact determination of the direction and velocity of the movment, nor of the depth of the focus.

In conclusion, then, the report fixes upon Zafarraya as the focus of this earthquake, and suggests a probable cause for it in the subterranean waters gathered there; but more exact results are yet wanting, and may very likely remain so, even when the fuller report is issued. This, however, will be awaited with interest, and wil contain valuable additions to the scie mology.

The report is signed by Manuel Fe Castro, Juan Pablo Lasala, Daniel de Co Joaquin Gonzalo y Tarin.

THE NORDENFELT SUBMARIN

Just before leaving Denmark for the Prince of Wales, with the King and Qu mark and the Czarina, witnessed off L a town on the Swedish coast, an inte successful trial of the new submarine b has been built at Stockholm upon th Mr. Nordenfelt, the inventor of the m so extensively used in modern warf

THE TRIAL OF THE NORDENFELT SUBMARINE BOAT AT LANDSKRONA, SWEDEN.

since the American civil war, naval eng been striving to solve the problem of navigation, but until now with very lit Mr. Nordenfelt's invention, however, fulfill the numerous requirements ne overcoming the difficulties and danger taining, driving and directing a boat b water. The boat is built of steel, an shaped, with a glass conning-tower in from which the commander can keep This dome is protected by a strong i There are three engines, one to work th the stern which propels the vessel, a work the propellers on either side, wh set in motion, compel the boat to sink, tain her at a certain depth beneath th When it is wished to sink the boat, e water is taken in to reduce the buoya

[1] From the London *Graphic*.

tower is just above the surface. The side propellers being then set in motion, the vessel can be sunk to any required depth, there being an automatic arrangement by which the engines are stopped directly that depth is exceeded. An automatic horizontal steering gear also prevents the boat from going down or up headforemost, an even keel being preserved throughout all the manœuvres. Should a breakdown of the engine occur, the boat from its own buoyancy at once rises to the surface. The motive power is steam, and as long as the vessel is above water the fires can be stoked, the smoke being driven through two channels, which pass partly round the hull and point aft. When, however, the boat sinks, the fires have to be sealed, and reserve steam is used, which is kept at high pressure in two tanks. With this the boat has been driven for five hours at a speed of three miles an hour. Her speed on the surface is eight knots. The crew numbers three, and during their submarine existence, they have to subsist on the amount of air which they take with them in the hull, in which four men have subsisted for six hours without any especial inconvenience. The boat is sixty-four feet long, and the central diameter is nine feet. The enormous utility of such a vessel as this in naval warfare is at once apparent. Moving without the slightest apparent sign of existence, she can launch torpedoes against hostile vessels, enter a harbor unperceived, and render useless the most complicated system of submarine mines. The trial at Landskrona was witnessed by officers representing every European power.

FOURTH CONGRESS OF GERMAN PHYSICIANS, 1885.

The fact that some of the most important work in medical science is being done in Germany, and that at the congress, whose proceedings have been recently published,[1] some valuable additions to medical knowledge were made, warrants a notice in the columns of *Science*.

The first subject discussed by the congress was corpulence. Ebstein advanced the opinion that drugs were of little service in reducing the amount of fat, and that an entire change in the regimen—including both change of diet and of the manner of living—was necessary. Any method which reduced the general nutrition, and thus removed fat, was a failure: the fat alone must be removed. The method must not require the individual to give up his business during treatment, else it would not be generally applicable. The method must be capable of being continued indefinitely without producing unpleasant results, for individuals predisposed to corpulence by heredity or constitution must keep up the diet for a long time. One method is to cut off all fatty foods. But as carbohydrates may be changed into fat in the body, this is not reasonable. The object is rather to prevent the formation of fat in the body. To secure this, it is necessary to regulate the proportion of albuminous, starchy, and fatty foods, so that perfect nutrition shall be secured, but no excess of fat produced. The necessary amount of fat for a healthy man is 142 gr. per diem. If this is reduced one-half, a part of the amount necessary for nutrition will be taken from the body to compensate for the reduced allowance in the food, and thus the excess of fat may be removed. Under this system the individual does not suffer the distress which is felt by those who are cut off from all fatty food, and the results are more successful and agreeable than those secured by the Banting system. The amount of carbohydrates is to be reduced so that no surplus above bodily needs shall be taken. In the Banting system the diet is chiefly nitrogenous, which often causes indigestion. Ebstein gives nitrogenous food, with the reduced allowance of starch and fat in sufficient quantity to keep up the general nutrition and working strength, but not in such amounts as to overload and embarrass the organs which digest proteids. The necessity of muscular exercise of sufficient force to produce free perspiration is insisted upon. This system has met with approval in Germany on account of its success.

Henneberg, in discussing the subject, approached it from a different side, and, by a review of the methods adopted in fattening cattle, sought to deduce the rules necessary to be observed in avoiding the accumulation of fat in man. The general discussion elicited varying views upon the physiology of digestion, but all agreed that the use of medicine for reducing corpulence was to be avoided.

The discovery and demonstration by Lustgarten of a bacillus of syphilis has already been alluded to in *Science*.

Measures to be adopted in combating fever formed the topic of one day's discussion of the congress. The well known property of quinine in reducing fever has led to a search for similar properties in organic substances allied to it in chemical constituents. Benzol, carbolic and salicylic acids, salicin, resorcin, hydrochinon, chinolin, kairin, thallin and antipyrin are such substances, and they have all been found of use as antipyretics. Many of them have, however, unpleasant effects; so that, at present, salicin, kairin, and

[1] *Verhandlungen des congresses für innere medicin.* Vierter congress, 1885. Herausgegeben von Drs. E. Leyden und E. Pfeiffer.

antipyrin are the only ones in general use. Antipyretics may act either by reducing the production of heat, *i. e.*, the oxidation process; or by increasing the amount of heat given out from the body; or by paralysing certain micro-organisms whose action irritates the heat producing mechanism; or by restraining and regulating the action of these heat producing nervous mechanisms directly. It is to the latter theory that Filehne and Liebermeister assent. The latter, to whom is due the use of cold baths in the treatment of fever, admitted that antipyrin was applicable in some cases where the application of cold was unadvisable. But cold baths are not to be given up. A healthy man in a cold bath (68° F.) gives off in ten minutes seven times as much heat as under ordinary circumstances. But his body temperature remains the same. Therefore the effect of the bath is to increase seven times the production of heat in the body. If the bath is long continued the temparature falls slightly. After the bath the temperature falls slightly. The same is true in fever with this difference, that the fall of temperature follows a cold bath more quickly, and to a much greater degree than in health. In many cases this removal of heat by bath is indispensable, even though it is accompanied by an increase in the production of heat, for in fever experience shows that the amount abstracted exceeds the amount produced. According to v. Jaksch, thallin in 0.25 dose produces a fall of temperature more quickly than antipyrin in 1. dose. It is apt, however, to produce a chill and sweat, and its effect is not so lasting as that of antipyrin. Neither of them affects the duration of a specific fever (such as pneumonia or erysipelas), or relieve the distress of the patient. In pneumonia and erysipelas their use prolongs the period of convalescence by reducing the recuperative powers of the patient. They are, therefore, to be used only in cases of fever in which the temperature rises to a dangerous point, or in which cold bathing cannot be used. To this opinion Strümpell of Leipzig agreed. Others maintained that the reduction of temperature gave the patient much comfort, relieving many distressing symptoms. All agreed that the use of cold baths, or cold sponging, was preferable to the use of drugs.

Asthma was the subject of a long and exhaustive discussion, which elicited a number of subdivisions of the affection of some therapeutic importance. Asthma is regarded as a nervous affection, attended by a sudden obstruction to expiration, with dilatation of the lung. It may be a primary disease due to changes in the nervous centres governing respiration. In the majority of cases, however, it is a secondary disease of reflex origin. An irritation arising at some point sets up an excitement of the nervous mechanism of respiration, which shows itself by the attack. Such an irritation may come from the mucous membrane of the nose when that is thickened by chronic catarrh, or covered with polypi, or irritated by some external material, as in hay fever, in which case operative measures on the nasal cavity, or anæsthetics applied to it, will cure the asthmatic attacks. Or the irritation may come from the finer bronchi, and the inflammation of these may set up a spasm, and thus cause the attack, in which case the treatment must be directed toward the bronchitis. The exact character of the spasm attending the attack is undetermined. Some regard it as a spasm of the diaphragm, which prevents this muscle from relaxing, as it normally does, in expiration. This view is based upon the fact that electrical excitement of the nerves to the diaphragm will produce results similar to those occurring in asthma, while excitement of the nerves to the bronchial muscles does not produce asthma. The majority of authorities, however, consider this theory questionable, and hold that a true spasm of the muscular coat of the finer bronchi causes the attack. All admit that the spasm, from whatever cause, is best combated by narcotics, of which morphine and chloral are the most reliable. But treatment of the attack should always be followed by treatment of the cause, especially if that is easily reached, as in cases of nasal catarrh.

Acute articular rheumatism has lately been regarded as an acute infectious disease like pneumonia and typhoid fever. The opinion was advanced by Edlefsen that it developed in certain localities in Kiel more frequently than in others, and he found, in investigating 845 cases, that persons living in certain houses were especially liable to the disease. He concluded that the micro-organism causing the disease is one which clings to dwellings, especially such as are built on damp ground, and advises persons who are subject to frequent attacks to change their residence. Such authorities as Jurgensen and Friedländer agreed to this view, and in support of it cited the fact that in certain barracks and hospitals, cases of acute rheumatism developed in great numbers. All admitted that the mortality had diminished greatly since the use of salicylate of soda was introduced.

A number of shorter papers of value were read, which are not of such general interest as to demand notice. The proceedings of this congress should be followed by all physicians interested in the progress of scientific medicine.

M. A. S.

SCIENCE.

FRIDAY, NOVEMBER 6, 1885.

COMMENT AND CRITICISM.

THE SCHOOL OF INSTRUCTION of the signal service at Fort Myer has been the scene of occurrences which show in a strong light the incongruity of having the weather service under military control. Some years since, General Hazen made known his desire to have educated young men, especially college graduates, enter the signal service as privates; and, under the promise of good treatment, he seems to have been quite successful in recruiting his corps from this class. The recruits are, however, required to learn the drill and duties of the common soldier. In this branch of their education, the class now under instruction proved so inapt that the drill-officer lost his patience and his temper, and expressed his sentiments in language unfit for ears more polite than those of the mules on the plains. The aggrieved young men wrote a letter of complaint to the chief signal officer, and for this offence they were promptly brought before a court-martial. The trial has been concluded, but the result has not yet been made known.

The case is instructive as showing the wide divergence between military discipline and common sense. While the young men were tried by court-martial, the officer whose ungentlemanly conduct caused the trouble was let off by what General Hazen is pleased to call a reprimand, but which was nothing more than a letter calling his attention to a certain paragraph in the army regulations. We can hardly suppose that this letter would seriously disturb the equanimity of an officer of the breeding indicated by the language of the offending lieutenant. Common sense would have dictated the trial of the officer by court-martial, and the reprimand of the men whose offence, as General Hazen himself says, was only that of going about a right act in a wrong way. We may admit that the chief signal officer knows best how so purely technical an offence against military discipline should be dealt with in army practice; but this only emphasizes the deviation of that practice from common sense when applied to a civil service like that of the weather bureau.

IN THE ANNUAL REPORT of the chief signal officer, just issued, it is claimed that meteorological work depends upon an accurate and continuous record, and that to get these conditions the observers must be held with an absolute control, which makes a military organization indispensable. It is further stated that the gathering of these observations is traditionally military work, and that "all that is of much value has been done under some form of military organization." While not wishing to disparage the faithfulness of the meteorological records of our own army surgeons, which are referred to as among the earliest, we think it must be acknowledged that the aimless records of temperature and barometric pressure of the past were made by those having much spare time upon their hands, whether surgeons at army posts or civilians. But meteorology is not a mere question of gathering records of observations. These records must be discussed, and the truths hidden in these masses of figures must be revealed, before any true science exists. We find that this need is recognized by the Army signal service, and that Professors Ferrel, Abbe, Trowbridge, Rowland, Pickering, Mendenhall, Wright, not to mention other younger men, and all civilians, have been employed as a 'study division' to improve the methods of taking observations and the instruments used, to prepare text-books on meteorology and meteorological instruments for the use of the service; in fact, to direct the whole work of the bureau. We do not forget the officers of the army who have done good work for the service and for science, but merely wish to call attention once more to the fact that the proportion of men fitted to conduct scientific work is small, and no larger among army officers than among civilians. There is, moreover, no evident connection between predicting the coming of a killing frost which will destroy the last of a growing cotton crop, a matter treated of in the latter part of the report, and skill in laying a field telegraph line, military signalling or drill, to which are devoted the opening pages. It is inevitable that the larger portion of the leaders of the service must be civilians. The work of the service is done for the benefit of commerce and agriculture, and it is in-

congruous that it should be in the hands of army officers.

WE NOTICE WITH MUCH PLEASURE the election of Prof. E. S. Holden to be president of the university of California, and director of the Lick observatory. Professor Holden's resignation as director of the Washburn observatory at Madison, Wis., takes effect on the 1st of January next. His appointment as director of the Lick observatory will hardly be a matter of surprise to those who are aware that, as consulting astronomer, he has virtually had the direction of the work as it has progressed, visiting the site on Mount Hamilton in 1881, and again in 1883 and 1884. Very happily the choice both of the Lick trustees and of the regents of the university has fallen upon Professor Holden. It is understood that in his letter of resignation to the regents of the university of Wisconsin, he strongly urges the name of Prof. W. A. Rogers, of Harvard college observatory, as his successor.

THE CREATION OF A NEW CHAIR of psychology at the Sorbonne, and the instalment therein of M. Th. Ribot, editor of the *Revue philosophique*, as professor, marks a new epoch in the relation of the university to philosophy in France, and is a most gratifying proof of the way in which the world moves. Safe opinions and literary smoothness have, for almost as long as any one now can remember, been stronger passports to French philosophic professorships than either learning or originality. But the renewal of the science of human nature by the physiologists, pathologists, and evolutionary anthropologists of this day and generation, has brought too great a mass of new facts with it, and of new conjectures, for any barriers to stand. They must be let in somehow, and officially taught and discussed, if the official teaching is not to appear ignorant and antiquated. The Ministry of public instruction has wisely seen this, and has had the sagacity to choose for the new professor the man who has done most to introduce the new ideas to his countrymen. M. Ribot's place at the head of the *Revue philosophique* is, to be sure, more important than any professorship; and a professorship would be but a faint reward for the service he has done to French philosophy by his admirable management of that periodical. But the two functions do not exclude each other, and we wish M. Ribot health and strength for a long career in both.

THERE IS NO GEOGRAPHER, biologist, or
gist, probably no statesman, on the othe
the Atlantic, to whom the name of Justu
is not full of meaning. It is not merely
house has helped, by its publications, ea
profession. It is not only because, of
graphical chart-work, theirs is pre-emin
most delicate, the most reliable, the mo
in the taste with which colors are us
rather because to the operations of a
means, business ability, and pride in f
geographical science, have been added t
of a succession of geographers who sto
to none in their specialties, and whose
was not merely pecuniary or personal. Th
of this house, Johann Georg Justus Per
the son of the physician to the Prince o
stadt, and was born September 11, 1749.
gaged in a commercial enterprise, out of
September, 1785, the establishment at Go
nated. Since then, after the death of the
the business has been carried on by
(1816–1853), Bernhardt (1853–1857), and
Muller and Rudolf Besser, on behalf of
mous son of Bernhardt Perthes and others
ed, nearly to the present time. In Septemb
centenary of the establishment was c
and a jubilee-volume, elegantly printed,
trated with portraits of the firm and
collaborators, has been distributed to its
and friends. This volume contains a bri
of the firm, of its connection with geo
literature, with geographers, and with
The part it has played in these matters
to the honor of all concerned. A table
the present organization is appended.
necessary to go into details with which
our readers are more or less familiar alr
is sufficient to say that a house to whic
the works of Berghaus, Stieler, Peterma
ner, Behm, and their associates, must be
among the ornaments of the German f
and the efficient forces of civilization.

PASTEUR AND HYDROPHOBI

THE recent communication of M. Pa
the Academy of sciences, upon the prev
hydrophobia by inoculation, has naturally
great interest among the general public a
in the scientific world. The methods an
of his experiments upon this subject hav
been published with sufficient detail to ju

positive judgment or intelligent criticism concerning them. If correctly reported, Pasteur is convinced that he has discovered means by which the virus of hydrophobia can be attenuated, and that, by the inoculation of the attenuated virus, individuals may be rendered, for the time being, insusceptible to the disease. The attenuation is said to be effected by preserving for a variable length of time pieces of the spinal cord of rabbits which have been inoculated with the hydrophobic virus. The longer the pieces of spinal cord are preserved, the weaker becomes the virus contained in them. It is evident that the spinal cord must be preserved in a manner not to decompose, and at the same time not to destroy at once, the hydrophobic virus. We are not informed how these ends are accomplished, but in accordance with Pasteur's doctrine of attenuation of virus, they must be reached without any obstacle to the free access of oxygen to the specimen. Of especial interest is the statement that inoculation with attenuated virus will prevent the outbreak of the disease, even when this inoculation is performed after the reception into the body of the strong virus by the bite of a rabid animal. There is no information as to whether this inoculation is effectual after the development of the symptoms of hydrophobia or not.

The conclusions of Pasteur, coming from so great an authority, will receive, as they deserve, respectful and serious consideration. It is understood that for no less than five years Pasteur has given the greater share of his time and labor to the study of hydrophobia. It is probable that his conclusions are based upon a large number of careful experiments upon animals. The two or three reported instances of preventive inoculation of human beings, which have excited such popular interest, and which have been reported with so much dramatic detail in the newspapers, can hardly lay claim to much scientific value in proof of Pasteur's views. Even if the number of reported cases were much larger, it would be necessary to use great caution in drawing from them positive conclusions, in view of the facts that the period of incubation of hydrophobia is very variable, and sometimes of many months' duration; that a considerable number of those bitten by rabid dogs never contract hydrophobia, even when no especial treatment has been adopted; and that there is great popular ignorance as to the symptoms and means of recognition of hydrophobia in dogs.

There is no evidence that the real nature of the hydrophobic virus has been discovered; indeed, we have, in June of the present year, the positive statement of Bouley, who is believed to be familiar with Pasteur's work, that no organism has been isolated or cultivated which can be considered to be the virus of hydrophobia, and that Pasteur's researches have been conducted without a knowledge of the biological properties of the suspected organism. The whole subject of immunity from disease by preventive inoculation is in a very unsettled state. We possess a mass of superficial observations and undigested conclusions on the subject, but we have very few positive and well-established facts. It is to be hoped that Pasteur's researches upon the inoculation and cure of hydrophobia will be found, when they are fully published, to add greatly to our knowledge of this subject, and that the blessings which are anticipated from his discovery may be realized.

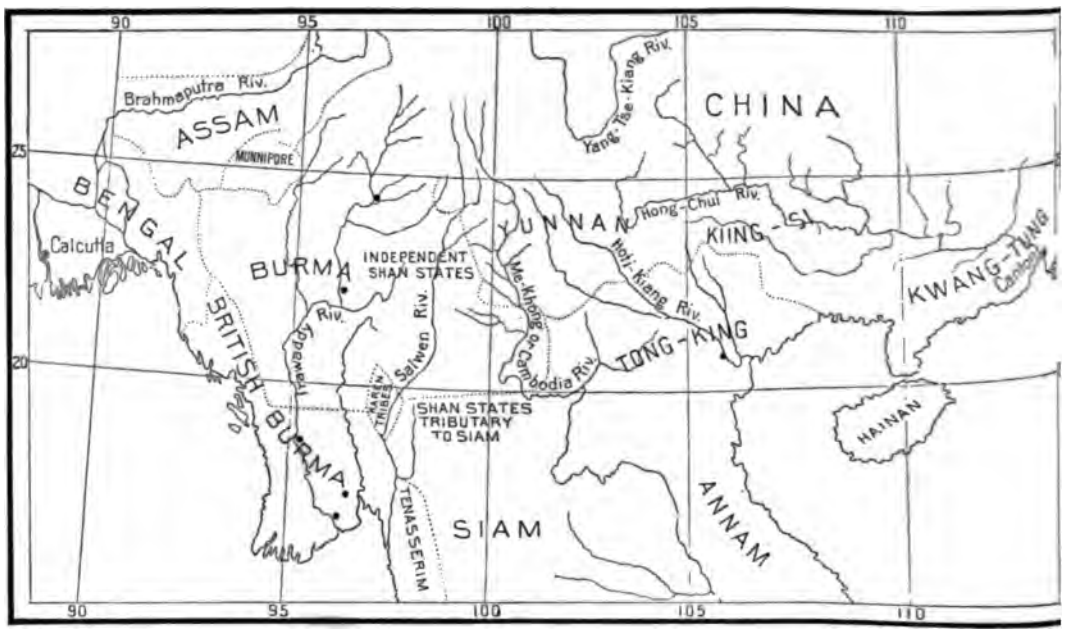
THE BURMAN DISPUTE.

THE Bombay-Burma company, a British corporation having very important interests in Independent Burma, was ordered by the Burman government to pay twenty lacs of rupees (about $1,000,000) in respect of their forest leases. The company replied that it was unable to pay such an enormous sum, and, furthermore, that no such payment was required under any reasonable construction of the grants from the Burman king. Judgment was accordingly entered against it. The company appealed to the British government, and on the twenty-eighth of last August 'the officiating secretary to the chief commissioner of British Burma' wrote to the Burman minister for foreign affairs, reciting the facts as they are here given. He then proceeded to inform the Burman minister that the British government — not the chief commissioner, not the Indian Viceroy, but the British government — 'cannot acquiesce' in any such proceedings. He asked that all further actions against the company should be suspended, and proposed that the whole dispute should be referred to a person skilled in judicial matters, to be appointed by the Viceroy of India. He closed by requesting the Burman government to 'make a very early reply' to these three questions: (1) whether the decree would be suspended; (2) whether the matter would be submitted to arbitration; and (3) whether the Burman government would agree to abide by the arbitrator's decision.

To an unbiassed observer this proposition that the government of one of the parties to a dispute

should appoint an 'arbitrator' to whose decision the other party — in this instance an independent sovereign, so far as the British are concerned — should agree to abide, even before knowing the arbitrator's name, seems to possess features as objectionable as they are novel. The Burman government did not take kindly to the idea of exposing all the secrets of Burman mal-administration to the gaze of a foreigner, even though he possessed the confidence of the Viceroy of India. A reply was accordingly drawn up, and sent to Rangoon in the most insulting way that could be devised. One sentence will show the weight which the despot of Mandalay attached to the demands of the British government. "The chief commissioner is distinctly informed," so this strange letter reads, "that on no account will there be any suspension of any order or action which it may be necessary to pass or take against the Bombay-Burma company pursuant to the judgment of the shildaw on the timber case." If the affair did not involve the lives of thousands of innocent Burmans, and also, as will presently appear, the continued trade supremacy of the English in the east, this reply of the ruler of less than four million partially-civilized and poorly-armed persons to an official letter of a servant of the Empress of India would appear simply ridiculous.

The matter was placed in the hands of Lord Dufferin, the present viceroy; and after some delay an ultimatum was sent to King Theebaw. In it three demands are made: namely, (1) that a person sent by the chief commissioner of British Burma shall be received with all honor; (2) that all proceedings against the Bombay-Burma company shall be suspended, pending his investigation; (3) that a British resident with a sufficient guard shall be accepted. If the first two demands are not conceded before a certain day, 'action will be immediately taken.' In other words, if the monarch of Burma will not submit peaceably to demands which were just in the eyes of Lord Dufferin, he will be compelled to submit to them and to become a vassal of the Empress of India. There are two sides to every question, and in the present case it must be admitted that, from a Burman point of view, Theebaw, the Lord of the White



Elephant, is acting entirely within his legal rights in confiscating to his own use any thing upon which he can lay his hands. It is hardly to be expected that the English would view the matter in the same light; and it should always be borne in mind that, as a late viceroy once said, when the English are attacked in their mercantile interests they are wounded in their most irritable point, and the present issue involves not merely the ruin of a particular commercial corporation. It is part of the contest for supremacy in the east which began years ago, in 1746, when the French captured Madras, and of which the end is not yet.

The first thing that strikes the eye when directed upon a map of Indo-China is the fact that all the great rivers of this region — the Hong-Chui (Lou River or River of Canton), the Hoti-Kiang (Si

ed River of Tong King), the Me-Khong or iver of Cambodia, the Salwen, and the y, all have their sources, with the possible n of the Canton River, in the unknown n regions of southern Tibet. Another le feature is a spur of the Tibetan ranges, xtending southwards between the valleys Bramaputra and Irawaddy, completely ts direct overland communication between India and the north-western provinces of Another important fact is that through- whole region, excepting, of course, the ltas of the Irawaddy and Me-Khong, the lleys are very narrow, the remainder of ntry being little else than a confused mass

is no regular overland communication the interior and the seaboard over which oods can be transported with any fair f profit. The rivers must be utilized to test possible extent, and it is a singular a fact nevertheless, that only one of these t rivers is capable of being navigated with steamers of a suitable size. The Canton ounds in rapids and difficult navigation, the end of his tedious boat journey the still far from the coveted tea mart of southern Yunnan, — a mart at which the grown in China, the so-called Puerh tea, buted. The Son Tai, or Red River of ng, at first seemed to offer a solution of lem ; but on further investigation it has o be filled with rapids, and to run through nd savage country sparsely inhabited by ibes ; and, as every one knows, the French nd, at the cost of much blood and treasure, nnan and Kwang-Si are as far off as ever. Khong, owing to its length alone, is obviously e question, while the Salwen is navigable than one hundred miles. The last river st is the great Irawaddy, which, rising in plored fastnesses of Tibet, flows in a gen- thern direction, by Bamo (at the head of on), by Mandalay (the present capital of rma, and incorrectly spelled Mandelay in), by Prome (at the end of the only piece ay in either Burma), and by Rangoon (the f the British Province of Burma, and the f the Irawaddy. Strictly speaking, Ran- on the Rangoon River ; but as the whole between Cape Negrais and the Salwen is alluvial plain, in which the Irawaddy, , Pegu, and Sittang intermingle in the kless confusion, it is not improper to speak goon as situated on the Irawaddy, with is in direct communication by a delta f this great river. Eight hundred and forty miles above the sea, Bamo (pronounced Bamaw) stands at the head of navigation, and only fifty miles away in a straight line is the Chinese frontier. The Irawaddy is thus the key to the trade of this part of the world, and the valley of the upper Irawaddy is Independent Burma. Can we wonder, then, that the English nation welcomes the excuse which the recent suicidal action of the Burman government has given it for taking possession of what will undoubtedly prove to be one of the most important trade routes of the world.

It may be said that I have overstated the desires of the English in this matter, and, to guard against any such reproach, a few sentences culled from the leading editorials of the London *Times* for October 15 and 17 are here introduced. The first is from the issue of the latter date, and is as follows : "It is as a high road to China that upper Burma is most valuable to us, and this road we shall now insist on keeping open, at any cost." The other quotation is somewhat longer, but is still more to the point : "Upper Burma is a strip of country interposed in the direct line between the eastern provinces of India and China. It is most important for our trading interest that the route between the two empires should be open. The establishment of another European influence [French?] in upper Burma could be regarded by the English only with dismay. But with the trade routes in English hands would come, not only trade, but, in time, not an alliance, but a friendly understanding between England and China,—two countries whose interests are identical, and whose enemies [Russia and France?] are the same." At first sight it may seem strange that such a valuable trade route should have remained unknown and closed to Europeans for so many years, and should have almost ceased to be used as a trade route within the past two decades. Yet such is the fact, though the causes of this strange development are not far to seek, and are to be found in the character of the races which inhabit upper Burma and south-western China.

With the exception of the regions surrounding the poles and a small portion of central Africa, there is probably no part of the earth's surface about which geographers are so ignorant as they are of the topography, hydrography, and ethnography of this part of Indo-China lying between the twentieth degree of north latitude and the sources of the Bramaputra and Yang-Tse-Kiang. It is known, however, that three routes lead from Bamo to Yunnan, and they have been traversed repeatedly in the last few years by Europeans, and will be found described in the books.

The Burmans are the ruling race of Burma, and, if we had space, would receive more than a passing

Passing over the boundary [illegible] that portion of Yunnan which [illegible] years was the scene of the Mohammedan [illegible] against the Chinese yoke. [illegible] rebellion of the Panthays, as the Mohammedans called in Yunnan, was finally crushed. [illegible] course of the eighteen years of civil war however, the country had been in great measure depopulated, its agriculture ruined, and its commerce paralyzed. Now, again, caravans are reported as arriving at Bamo. This part of our globe is so rich in the products of its soil, in the mineral wealth lying within easy reach, [illegible] the cost of transportation was not so great, and in its splendid forests of teak and other hardwood trees, that there seems no doubt but that

[illegible] frontier, [illegible] capable of [illegible] and even now [illegible] life. The [illegible] rather than to the Burmans [illegible] southern tribes are [illegible] theory, are the Burmans [illegible] In practice, however, [illegible] of the Burman government [illegible] less as one gets away from the [illegible] centre of Mandalay, [illegible] the Yunnan frontier is reached. [illegible] Shan tribes are reported as paying a [illegible] tribute to the rulers of [illegible] obeying neither.

[illegible] populated, its agriculture ruined, and its commerce paralyzed. Now, again, caravans are reported as arriving at Bamo. This part of our globe is so rich in the products of its soil, in the mineral wealth lying within easy reach, [illegible] the cost of transportation was not so great, and in its splendid forests of teak and other hardwood trees, that there seems no doubt but that [illegible] [illegible] [illegible]

the old mouse, in less than three hours. ese mice, after their first removal, when d in the field, directly become stupid or y dormant, it might naturally be inferred e heat had seriously affected them; but, as e seen, such was not the case. During the g of the day following my replacing them field, the air became cooler by twenty-nine , by 7 P. M., and was thirty-four degrees four hours later; and the mice were active d heartily upon bread crumbs placed near est. Now, why, it may be asked, did they k out a cooler retreat in the woods near by? only suggest that the supposed æstivating on was not inconvenient or unpleasant, and was preferable to the abandonment of their hich was suited to their needs for all time, such extraordinary spells of hot weather. these mice were excessively stupid, or a it condition, caused by excessive heat, was ; unusual with them.

e is, in this instance, a marked difference hibernating sleep, in that the period of dor- was of but a few hours duration; but was torpid slumber of a hibernating animal, in e condition was one from which it was not to arouse them, as from ordinary slumber. vakening had to come from a change of ature, and just in proportion as the evenings arm, the mice were tardy in returning to usness. To more effectually test this, I y removed these mice from the field, and them near a stove, so that the midday tem- e could be maintained. The result was the ance of the dormant condition for eighty- urs.

n the effect of a protracted drought and terms upon our animals has been more fully out, I believe it will be found that many a and other small mammal which is found ead as supposed, is really not in a moribund rmant condition, and if left undisturbed, revive. But what other evidence is there ? The white-footed mice are not, of them- sufficient to prove that æstivation is an es- ed habit. What other evidence among als have we?

ugust, 1880, I found bats on four different ns, all of which were apparently in full yet they did not, for some reason, which I ed to be excessive heat then prevailing, , at sundown, their crepuscular flights at ual hour. These bats had 'gone to roost' leaves on trees and a grape-vine, and were, bt, fully intending to resume their activity e nap of a day's length was over. Why y not? The following days were excessively hot, until the fourth, which was a few degrees cooler. It clouded over early in the afternoon; soon it became damp, and just before the commencement of a passing shower, these bats were stirring a little, as they hung. Quivering their wings, as though to see if all was in working order, and then, away they flew, after, in each case, nearly ninety hours of rest. Does it adequately explain all the facts to say that these bats were overcome by the heat? They were resting in the shade during the whole day, and the nights, when they would be active, were cooler; but in these cases, very little cooler. They were nights to be remembered for their sultriness, and may it not be, that there was not sufficient difference in the midday and evening temperature to enable them to throw off the nervous prostration caused by the heat of the day? Explain it thus, and then we are left to consider what is this nervous prostration? In the case of the bats mentioned, they were all in a perfectly torpid state, and gave not the least sign of life when handled; and only flinched slightly, when wounded by being pricked with a needle. Would not nervous prostration that produced insensibility, lasting several hours, almost certainly produce death? In the case of the bats, a torpid condition of ninety hours produced no ill effects. I am disposed to believe that the coming hot and dry weather was anticipated, and these bats retired for the purpose of escaping it, and entered into a condition widely different from ordinary sleep, which was to last until the so-called heated term was over, the lowering of the temperature being the one means through which they would be restored to consciousness. There occurs this deliberate action on the part of certain mammals, which regularly hibernate—why should not the same be true of them when the extreme is one of heat, instead of cold?

As bearing upon this question, let me quote a few lines from the Encyclopedia Brittannica—ninth edition—article, Hibernation. It says: "The dormouse not only hibernates in the strict sense of the term, but will sleep at intervals for several days together, during mild weather. When a Myoxus, an allied animal inhabiting Africa, was brought to Europe, it hibernated as if this were its normal habit. Whether it æstivates in its native country is not known, but its hibernating in Europe shows a greater power of adapting itself to changed conditions of life than we should have been inclined to suspect."

I would briefly call attention to two points in the above: that in temperate climates prolonged sleep is not unknown among rodents; and also, that some tropical rodents probably æstivate. In the case of the white-footed mice, and, too, of the

bats, I am very positive that their condition was not that of ordinary slumber, and the tropical temperature, at the time, even through the night, certainly suggests æstivation as the most plausible explanation of the phenomena I have described.

C. C. Abbott.

THE LIFE OF GEN. EMORY UPTON.

General Emory Upton, at the time of his early death in 1881, was probably the most accomplished officer in the United States army. He had a genius for the science of military tactics, and, as a thinker and writer upon this subject, has left a name of enduring renown. General Michie, the well-known professor of physics at West Point, aided by General James H. Wilson, who was distinguished in the cavalry service during the civil war, has recently published an extended memoir of Upton, tracing the various steps of his advancement through boyhood, with his strong desire to go to West Point; through his cadet life, in which he won high rank; through his varied and arduous experience in the three branches of army service during the war, winning success in each; through his career as the commandant of cadets, as an instructor in artillery at Fortress Monroe, as an official observer and student of the armies of Europe and Asia, and especially as an authority on military principles and practice. General Wilson says of Upton, that he was "as good an artillery officer as could be found in any country, the equal of any cavalry commander of his day, and, all things considered, the best commander of a division of infantry in either the union or rebel army." This is high praise, but the volume by General Michie shows how such success was won, and leads us to believe that Upton's name, as years roll by, will be honored more and more as one of the greatest tacticians of modern times. His personal character was as remarkable as his professional. Like Havelock, Stonewall Jackson, Chinese Gordon, and many other heroes, he developed a religious life of the purest and most lofty type. Toward the end of his life he was engaged upon a study of the military policy of the United States during the revolution, and from that time down to the year 1862, when his manuscript ends. In this work he was associated with his classmate at West Point, Col. H. A. Du Pont, by whom the task will doubtless be completed. From the outline given by General Michie, it is clear that the treatise will be of the greatest value, not to military men only, but to all students of history, and especially men. It will throw a great deal of lig causes of success and of failure in th campaigns which have taxed the resour countrymen. The publication of this m is greatly to be desired.

As a soldier and as a writer, Upton described as one who applied the pri scientific method to the organization an ment of armies. His aim was lofty; h was great.

Life and letters of Emory Upton, Brvt. Maj.-Gen. U. S. army. By Peter S. Michie. With an introduction by Jas. Harrison Wilson. New York, *Appleton*, 1885. 28+511 p. 8°.

DOOLITTLE'S PRACTICAL ASTR

Professor Doolittle has given us an manual, either for the student or for t in the field. Intended only for field and navigation, we find no treatment o tory methods with large instruments, b field is thoroughly covered. "The auth sought after originality, but has atte present in a systematic form the most methods in actual use at the present tin a comfort to turn the pages and find formulæ in a familiar dress. Much of nality' of many modern text-books rigging out old accepted formulæ in a betical suit, so that no one can be quite using just the right one without constant to the great 'original.'

We can only give an outline of the The introduction develops in a si thorough manner the method of least-sq the subject of interpolation. The differe of spherical co-ordinates, the formulæ transformation and for parallax, refrac are very completely developed. Under t of angular measurements, verniers, mi microscopes, graduated circles and the of error, chronometers, clocks, and chr are fully described and investigated. treatment of the adjustments and err sextant, is introduced an example of th nation of the eccentricity by star ob from the work of Professor Boss on th boundary survey; and chapter v. deve oughly the best methods of determinin latitude by the sextant or any altitude in The transit-instrument in its various f in the meridian and prime-vertical, is treated; likewise the determination of by chronometers, by telegraph, by lunar by moon-culminations, and by occultatio Of course, the zenith-telescope claims its of attention, and an unusually comple

A treatise on practical astronomy, as applied and navigation. By C. L. Doolittle. New Y 1885. 8°.

on the determination of azimuth follows it. The book closes with a very full and clear setting-forth of the subjects of precession, nutation, aberration, and proper-motion, with the formulæ for their application, and a set of tables most useful to the field-astronomer in reducing observations.

The most valuable and characteristic feature of the book is the excellent series of examples taken from actual modern practice, which accompany almost every method of using each instrument, and are fully discussed by the method of least-squares where its application is advantageous. There is throughout an endeavor to impress the importance of developing the degree of accuracy inherent in the observations, and the best methods of avoiding or eliminating systematic errors. The whole work bespeaks the thorough master of his subject. The warning as to parts of the normal-equations solution not checked by the proof-formulæ, the giving of the complete values of the auxiliaries in the formulæ for the weight-coefficients out to four unknown quantities, and many other points which would be overlooked by the mere book-maker or pure theorist, show that Professor Doolittle has thoroughly beaten the whole ground, and knows where the difficulties lie.

The typography of the book is excellent, and Professor Doolittle's known thoroughness gives us assurance that much less than the usual number of mistakes will be found in the printed text.

MEXICAN ETHNOLOGY.

THE magnificent ethnologic museum of the Trocadéro at Paris is one of the sights of that great capital which no scientific visitor should overlook. It is particularly rich in its American department, and the conservator of the museum, Dr. Hamy, has taken a pride not only in collecting in this department, but in studying his specimens and in publishing the results of his studies. As editor of the excellent *Révue d'ethnographie* he has always at his command a medium to give them promptly to the world. He has collected a number of these studies under the title, 'Decades Americanæ.' They treat of such topics as 'An anthropolith from Guadelupe,' 'Fishing industry in ancient times in the Californian Archipelago,' 'The Tzompantli,' 'An Aztec arrangement for supporting skulls,' 'The American solar wheel,' 'A pipe from King's Mound, Ashland,' etc. All these articles are freely illustrated, and the specimens are described and discussed with clearness and from an astonishing width of special reading.

The 'Anthropology of Mexico' is a work of much more ambitious character. In this large and handsome quarto published by the French government, Dr. Hamy discusses the human remains that have been collected by French explorers in various portions of Mexico. He places them in relation with the oldest relics of the stone age from the same region, and reaches the conclusion that the implements, at any rate, point to a period and condition of human life exactly the same as existed in the United States and Europe during the epoch of unpolished stone. In the crania examined the principal characteristics were marked prognathism and brachycephalism. These traits the author thinks are especially pronounced in the skulls of the Otomis and Mazahuas. Besides the minute descriptions and abundant lithographic illustrations with which he enlightens his topic, he enters somewhat fully into the earliest legendary history of Mexican ethnography, attempting to define more closely the identity and relations of those mysterious people, the Quinamies, the Olmecs, and the Xicalancos. He wisely, however, treads with caution on this very uncertain ground.

Mission scientifique au Mexique et dans l'Amérique Centrale. Anthropologie du Mexique. Par. M. E.-T. HAMY. Paris, *Imprimerie nationale*, 1884. 4°.

Decades Americanæ. Mémoires d'archéologie et d'ethnographie Américaines. Par le Dr. E.-T. HAMY. Paris, 1884.

ASTRONOMICAL NOTES.

Longitude signals between St. Louis and Mexico. — Professor H. S. Pritchett, director of the observatory of the Washington university at St. Louis, kindly communicates the results of a longitude campaign between his observatory and the Observatorio nacional de Mexico, Sr. A. Anguiano, director. A preliminary discussion gives $35^m\ 57^s.25$ as the difference of longitude, or $6^h\ 36^m\ 46^s.41$ W. of Greenwich as the resulting longitude of the transit-circle piers of the Mexican observatory. This differs $5^s.0$ from the old value determined by moon-culminations. The circuit was 2583 miles long, with five repeaters, and the armature time was quite constant, averaging $0^s.38$. The outfit of the Mexican national observatory includes a 15-inch equatorial by Grubb, and an 8-inch meridian-circle, and a 6-inch transit, both by Troughton and Simms. The *personnel* consists of the director (Sr. Anguiano) and five assistants.

Comet observations at Greenwich.—The somewhat unusual appearance in the *Astronomische nachrichten* (2688) of comet-observations communicated by the astronomer-royal attracts our attention, and we trust this is only the beginning of a continuous series. One point, we think, is worth noting. As communicated, they give the meas-

ured $\Delta\alpha$ and $\Delta\delta$, and then the *combined* correction for differential refraction and parallax. As every computer of the final orbit of a comet wishes to use his own corrected distances in applying the parallax, and as the distances used above are not stated, he must in this case re-compute both the differential refraction and the parallax-factors. It would certainly be better to publish the $\Delta\alpha$ and $\Delta\delta$ corrected for refraction, and the '$\log p\Delta$,' according to universal custom.

New or variable stars. — Mr. W. H. S. Monck, in the *Observatory*, 1885, 335, makes the suggestion that the new or temporary stars that occasionally appear may be due to swiftly-flying meteor streams in space, meeting a nebula or gaseous mass, either bright or dark, and suddenly heating a part to incandescence, as in the case of shooting stars striking our atmosphere.

Discovery of an asteroid. — A telegram from Professor Pickering announces the discovery on October 27 of a new asteroid, by Perrotin of the Nice observatory. Its position on October 27, at $7^h\ 12^m$, Washington mean time, was: right ascension, $1^h\ 8^m\ 53^s$; declination, $+7°\ 8'$, with daily motions of -36^s in right ascension, and $-7'$ in declination. This is the eighth asteroid discovered this year, and the sixth discovered by Perrotin.

Mr. Chandler's Almucantar.—We recently noted (*Science*, vi. 239) Mr. Chandler's correction to the latitude of the Harvard college observatory from almucantar-observations. Since then he has unquestionably shown (*Astr. nachr.*, 2687) that this instrument is capable of detecting slight errors in the positions of even some of the '*hauptsterne*' of Auwers' system, and of furnishing valuable corrections to them from a comparatively limited number of observations. Mr. Chandler's promised memoir upon the construction, theory, and use of the almucantar will be awaited with unusual interest.

Death of General Baeyer.—Geodesy has lost its most illustrious representative in the death, at the advanced age of 91, of Dr. J. J. Baeyer, founder of the European *Gradmessung*, president of its central bureau and of the Royal Prussian geodetic institute. He died on the night of September 10–11.

NOTES AND NEWS.

According to the report of Superintendent Wear, of the Yellowstone national park, the maintenance of a strict watch day and night has resulted in breaking up, in a measure, the wholesale slaughter of game; and the park is now full of game of all kinds, including about two hundred head of bison, large numbers of elk, and several herds of antelope. By the new roads, access the objects of interest is facilitated. It is recommended that the force of assistants be increas from ten to fifteen, as the present force is r large enough to prevent the commission of acts vandalism. The travel in the park this summ has been much greater than ever before.

— President Porter has sent to the corporati his resignation of the presidency of Yale colle the resignation to take effect at Commenceme next June. He will, however, retain his positi as Clark professor of moral philosophy.

— King Leopold of Belgium, it is reported, h already found the Kongo Free State a more e pensive enterprise than he can carry on unaid His recent visit to Wiesbaden was made, it is sa for the purpose of inducing some one of the G man princes to assume the sovereignty of Kongo country in his stead.

— R. T. Stupart, the Hudson Bay observ who abandoned his station at Stupart Bay the d before the steamer Alert reached there, arrived Halifax on Saturday, Oct. 31, on the steam Miranda from St. John's, Newfoundland. Th voyage of twelve days in an open boat to F Chimo was exceedingly perilous.

— Supplementing the regular course of instr tion at Sibley college, Cornell, a series of lectu on mechanical engineering will be delivered fr time to time by members of a body of non-resid lecturers who have been chosen from among most distinguished men of the profession. Th gentlemen choose their own subjects, and time lecture, and their own method of presentation the subject selected. The director of the coll announces that the following named gentlem are engaged to lecture during the year 1885– Dr. E. D. Leavitt, jun., Dr. R. W. Raymond, C. E. Emory, Mr. Charles T. Porter, Mr. J. M. All Mr. J. C. Hoadley.

— A petition to congress for a deed to S Miguel mountain — an excellent situation for observatory, near San Diego — has been circula by the San Diego society of natural history.

— The San Diego society of natural history h taken steps for the protection of the nearly exti Punis Torreyana of San Diego county.

— The 'Lungen gymnastik' of Th. Huper really a handbook on the care and developm of the lungs, and the attendant and reflex adv tages of such care. Though he says it is for physician, yet its style and method are such tha may be most successfully used by the laity. T

structure and uses of the organs are just enough dwelt upon to make the subject clear. Besides the common ideas of the injuries of impure air, he tells of the evils of carpets, drapery, curtains, and upholstery as introducing bad air into our living apartments. He comes down heavily on the fear of slight draughts of air. If any adverse criticism is to be made, it is that the author does not make enough of the impure exhalations of the lungs and skin as injuring the air, laying the sin of air-poisoning too much at the door of carbonic acid. And the perils of carbonic oxide, as found in the products of combustion of water gas, are not dwelt upon.

— One of the best compends on its subject that has yet appeared is Edinger's ten lectures 'Ueber den bau der nervösen centralorgane,' just published at Leipzig. The subject is beset with very many difficulties, and there are many controverted points at every step, and many degrees of certainty about what is generally accepted. The author is, moreover, an original investigator, liable to give too great prominence to his own work. Despite all these difficulties, however, we have here without doubt the most lucid and the most judicious presentation of the subject of the finer internal anatomy of the nervous system yet made in so small space. The work contains 120 illustrations, many of them original, which add greatly to its value. We have long needed a concise presentation of this subject, which should include, as none of the larger and well known manuals do, the results of recent investigations, especially those of Meynert and Flechsig, to which full justice is here done. It is sure to prove of peculiar value to teachers. If another lecture could be added on the embryology of the normal brain, the value of the book would be increased.

— E. Wasmandorff has published (Virchow's and Holtzendorf's Sammlung wissenschaftlicher vorträge, ser. xx.) an exhaustive study of the various forms, in which sorrow for the loss of friends has manifested itself among all peoples, ancient and modern, civilized and savage. Fortified by a wealth of references to original sources of information, it constitutes a valuable contribution to anthropological science. It is impossible, within our limited space, to give more than a single example of the author's interesting generalizations. The ordinary colors of mourning garments are black and white. As is the European custom, black prevailed among the ancient Egyptians, Hebrews, Greeks, and Romans, and the native races of this continent. White is the color among the inhabitants of China, Japan, Oceanica and large portions of Asia; so also in parts of Greece and anciently in Germany. Blue is the color in Arabia, and among the Turks and Egyptians, and in Catholic upper Germany it is prescribed by the church. Yellow was used by the ancient Celts and in some of the kingdoms of Asia.

— Several inquiries having been made of us relative to our statement on page 351, that an 'actual competitive examination' was required for admission into the Royal society of London, we print from *Nature* the following extract from Professor Chrystal's address before the British association, which seems to warrant what was said: "I think our great scientific societies — the Royal societies of London and Edinburgh, and the Royal Irish academy — might do more than they do at present to prevent this languishing of local science, which is so prejudicial to the growth of a scientific public. Besides their all-important publishing function, these bodies have for a considerable time back been constituted into a species of examining and degree-conferring bodies for grown-up men, that is to say, their membership has been conferred upon a principle of *exclusion*. Instead of any one being *admitted* who is willing to do his best, by paying his subscription or otherwise, to advance science, every one is *excluded* who does not come up to the standard of a certain examining body. So far is this carried in the case of the Royal society of London, that there is an actual competitive examination, on the result of which a certain number of successful candidates are annually chosen."

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The care of pamphlets.

IN response to the demand which Mr. Goode makes in *Science* of Oct. 16, for descriptions of methods of caring for pamphlets, I describe my own method.

Each pamphlet is perforated at the back with holes to admit a cord. This is most conveniently done with a cutting punch, which makes a round and smooth hole, but it can be done with an awl. Cords are then passed through these holes, and any number of pamphlets may be bound together. Whenever it is desired to insert a new pamphlet, or to rearrange the old, the cords can be withdrawn and re-inserted. To facilitate re-arrangement, all holes are made at exactly the same height above the lower end of the pamphlet. If, then, all the pamphlets on the fauna of a country, for instance, have been bound together temporarily, and it is desired to rearrange them by zoölogical groups with the groups of other faunas, no difficulty in regard to the binding arises from the interchange. These holes are made, for octavos, at 2.5, 7.5, 16, and 21 cm. from the lower edge of the pamphlet; for duodecimos, at 2.5, 7.5, 11, and 16 cm.; for quartos, at 2.5, 7.5, 21, and 26 cm., etc.: so that pamphlets of any two or more

sizes can be bound together. Detailed reasons for this choice of distances may be found in my article entitled 'Standard covers for temporary binding,' in the *Library journal*, Jan , 1883, viii. 6, 7.

Covers for these pamphlets are punched with holes in the hinge or flap at the same distances, so that all covers fit all pamphlets. One or one hundred pamphlets can be inserted in a cover. The backs are made of heavy manila, as wide as the thickness of the book, with a margin folded over to be punched with holes, so that the back is laced between the pamphlets and the cover. By lacing the backs to the covers first, with thread or otherwise, and then inserting the pamphlets on a separate cord, the covers do not fall away when the binding cords are withdrawn. Of course, if desired, the backs can be glued to the covers.

One objection to Mr. Goode's method of having stubs permanently bound in the covers is, that no such re-arrangement can be made as may be desired. The backs are also of definite width, and cannot be enlarged as may be required for convenience. A pamphlet cover made as I recommend, if not tightly laced, will admit of laying in 50 per cent more pamphlets than are tied in, before it is necessary to rebind.

If for any reason it is desired not to mutilate a pamphlet by making holes in it, it can be glued to a stub, or placed in an envelope glued to a stub, and the stub can be perforated.

Manila sheets can be prepared by the thousand, perforated with the standard holes, and newspaper scraps, etc., mounted upon them as desired, and these bound with the pamphlets. By pasting only on the recto, and marking the guide words or symbols on upper left-hand corner of verso, these words or symbols can be readily caught by the eye as the leaves are turned. When scraps occupy more than one sheet, the several sheets can be glued or tied together, so that they may afterward be handled as units. It will be found better in the end to put but one scrap on a sheet, so that the sheets may index themselves in the arrangement.

Next as to the arrangement and classification. The Dewey decimal classification and relative index is pronounced by many of the foremost librarians to be the greatest invention of the century in library economy. Its applicability ranges from that of assisting the school-boy to keep his notes to that of the president of the Royal astronomical society in classifying his library. Its simplicity is that of the Roman alphabet and the Arabic numerals; its comprehensiveness is that of assigning a subject number, for instance, to the 'spherical excess in the computation of a triangulation in geodetic work,' viz., 52,641; or separately indicating 'songs for male voices' (78,487), and 'songs for female voices' (78,488). Its index, in the new edition just issued, contains nearly 9,000 topics, and three tables allow these topics to be developed fully one hundred fold without loss of simplicity. One reference usually suffices to find the subject number of a topic, and by it a set of ten manuscript notes could be marked so that they need not be marked over to locate them in a library of ten thousand volumes, for the symbols would indicate not only what they were about, but where they were.

The use of this system can be seen in my own library and manuscripts, or in the catalogue I am making of the books and pamphlets in the entomological division of the U. S. department of agriculture. A description of the system is given in chapter xxviii. (pp. 623–648) of the special report on libraries published by the U. S. bureau of education in 1876.

I pay about one cent each for my pamphlet covers, octavo or quarto. They are serviceable, but not elegant, but they hardly show on the shelves.

B. Pickman Mann.

Star catalogues.

Would you please tell me where I could obtain a catalogue of the stars, and what would be the cheapest price I would have to pay? H. C. I

[If our correspondent would state a little more definitely the use for which the catalogue is desired, we should be glad to give the necessary information. A great number of star catalogues are published, no two just alike. The star list of the *American ephemeris* (to be obtained from the office of the *American ephemeris*, Washington, price $1) would perhaps answer his purpose; while, for identifying the constellations, etc., Heis's *Atlas cœlestis novus* would probably be found most useful; and Webb's 'Celestial objects,' giving a valuable list of colored stars, nebulæ, clusters, etc., should be owned by every one that possesses an astronomical telescope. — Ed.]

Calendar reform.

I notice in the supplement to No. 140 an article on reform in our calendar, by Mr. Paul. He refers to two changes in our method of reckoning time proposed by M. Jules Bonjean, one affecting the monthly calendar, the other the weekly.

Changes in the monthly calendar in past time have by no means been infrequent, but of such a capricious character as to result in great irregularities and an inconvenient arrangement. This is a fair subject for reform by way of simplification. But a change or break in the weekly cycle, for the sake of beginning every year with the same nominal day of the week, is quite another affair. Here we should touch upon questions of religious belief, which cannot be discussed in the columns of *Science*.

But the monthly calendar, being of human devising, is open to improvement. In regard to this, M. Bonjean's proposal and my own, in No. 108 (Feb 27), agree in placing the intercalary day at the end of the year, and in making the months to consist alternately of 30 and 31 days. But he would begin the year by giving January 30 days and February 31, and thus proceed. This method would require a change in the number of days in 8 months out of the 12 in ordinary years. But by beginning the first half of the year with a month of 31 days, and the second half with one of 30 days, as in our present calendar, only 2 months would be changed in an ordinary year, including December; and in leap year only February and July. Thus convenience and symmetry would be secured with the least possible change.

Edward P. Gray.

The swindling geologist.

A thief representing himself as Leo Lesquereux, jun., and also as one Strong, son of the geologist who was drowned in this state some years since, has been doing this part of the country of late, making way with geological reports, instruments, and specimens. He has been apprehended, and is now in the jail at

Elkhorn, Walworth county. Wis. His term will expire January 28, or within a day or two of that time. He is the same man who has carried on extensive swindling operations of a similar nature in the east.

Would it not be well to have him 'sent up' as many times as possible? I send you this information, hoping that it may seem wise to you to make his whereabouts known through your widely-circulated columns, and to encourage all interested to make it as warm as possible for this impostor. He very probably assumes other names than those I have given.

He is rather short, of light complexion, has a cynical expression, wears eye-glasses, talks with the greatest freedom of geologists, finding few worthy of recognition or favor. He looks to be thirty years, but represented himself here as forty-six. He told in many places about here, but did not say it here, that he was distributing specimens from the Smithsonian institution. He imposed upon many in that way. He is conversant with geology and geological work, and is certainly well posted on fossil plants.

Prof. N. H. Winchell, Minneapolis; Prof. W. F. Bundy, Whitewater, Wis.; Smith D. Atkins, Freeport, Ill. — are men who know his operations hereabout. R. D. SALISBURY.

Beloit, Wis, Nov. 2.

Recent Proceedings of Societies.

Academy of natural sciences, Philadelphia.

Oct. 27. — Mr. John A. Ryder made some remarks on a new theory of the development of limbs and their muscles, which he had elaborated in the course of his embryological studies. These have led him to conclusions very similar to those defended by Prof. A. Dohrn and Dr. Paul Meyer, of Naples, though Mr. Ryder's results have been reached quite independently of the European investigators. The new views assume that great modifications of development have been induced by the presence of yolk and by intra-maternal changes. Somewhat modifying Haeckel's views as to the gastrula mouth, the latter is supposed to have become greatly elongated antero-posteriorly. The muscular segments or myotomes are supposed to have been developed from the edge of such a primitive mouth either directly or indirectly, thus giving rise to metameric segments enclosed by the larval skin or epiblast. The muscular segments then push out processes into pockets or folds of the latter to produce the various types of limbs. A large amount of detail was used in illustration and expansion of these views, in the course of which it was shown that the methods of comparative anatomy alone were no longer capable of dealing with many of the more important morphological problems without help from the science of embryology.——Dr. H. C. Wood gave the results of experiments on the effect of injecting gastric juice into the blood of animals. A plan having been devised for indicating graphically the changes in temperature, it was found that an active fever was quickly produced. It was observed that the heat of the body was inverse to the amount of heat given off, thus indicating that fever is a complex process, depending on the relations of heat production and heat dissipation. The action of the pepsin in such cases is not clear, but it probably influences the nerve centres.—— Mr. Lewis Woolman called attention to a very symmetrical bowlder from the neighborhood of Thirty-first street and Haverford avenue, which was quite angular, although associated with rounded pebbles, and which contained on one side impressions of fossils. These were identified by Prof. Heilprin as Orthis and Atrypa spinosa. They were the first Devonian fossils to which his attention had been drawn in this connection.——Instantaneous microscopic photographs, by Mr. D. S. Holman, of Amœbæ, were exhibited. The views show, for the first time, the remarkable changes of form occurring in these organisms in the space of a few seconds.

Natural science association, Staten Island.

Oct. 10. — Mr. Hollick showed plants of the partridge berry (Mitchella repens, L.) bearing peculiar leafy berries, and made the following remarks upon the same: "Last autumn I mentioned finding some of these berries at Tottenville, with green leaves apparently growing out of the top or sides. On first sight these leaves appear like developments of the calyx lobes, but on a close inspection it is seen that the green leaves are growing from expanded petioles, which have tightly clasped the berries to a greater or less extent, and assumed their red color. The line between the berry and its enclosing envelope is not always distinct; but during the winter specimens which had been frozen were examined, and in them the line could be traced far more distinctly, owing to the berry being somewhat shrunken. These berries were kept in water for some time, and, although they and the stem leaves retained their colors perfectly, yet the adventitious leaves soon turned yellow and withered away. During the past summer and present autumn the locality was again searched for fresh specimens, and a number were discovered. In the newly-developed berries, as might be expected, the clasping petioles had not yet assumed the pure red color, many being of a duller red, and some distinctly streaked with green. After having been kept in water for a few days, however, the red became uniform throughout."——Mr. Congdon exhibited a spider covered with a fungoid growth, a species of the genus Achlya, and gave an account of its life history. This fungus is frequently found on insects which have fallen into the water, as in the case of this spider. It begins as a microscopic germ. A small thread next grows out from one side, bifurcating as it extends, until by repeated subdivisions it has formed a complete network of delicate threads It reproduces itself asexually by means of the protoplasm in these threads, which breaks up into little balls, and when ripe is expelled into the water. They swim about for some time by means of ciliæ placed at either end, which finally settle down on the body of the nidus, and in a short time have grown into a plant like the parent.——Mr. W. T. Davis exhibited a deformed specimen of Danais Archippus, the monarch butterfly. On the 6th of August a full grown caterpillar was collected, and, after having transformed to a chrysalis, was removed from its point of suspension and a pin passed through it. This chrysalis was intended for a cabinet specimen, but it was noted as time went on that it gradually changed color, assuming the tints peculiar to the chrysalis before the butterfly emerges. On the 21st of August the butterfly hatched out, having developed about the

pin. This pin passes through the body at or near the second abdominal segment, being very close to the ventral surface.

Microscopical society, New York.

Oct. 2. —G. F. Kunz stated (*Jewellers' circular*) that a necklace was being made by Messrs. Tiffany & Co. of petrified eyes, and that three workmen who were engaged on the necklace had been made suddenly ill, and refused to resume work on such dangerous material. The so-called mummies' eyes are well known, and are, without question, the crystalline lenses of the eyes of a species of cuttlefish (squid). Some of the lenses from the eyes of these cuttlefish measure only 5 mm., but the majority of them are 12mm. in diameter, and some as much as 18mm. The color, really only the result of age, is a dark amber yellow, or golden bronze, externally on the convex side. In all cases they are nearly opaque, and have the appearance of an onion-skin or any other sack like concretion. On the flat side, however, the color is much lighter, and a little play of light is noticeable. The surface is rough, as if an exudation had hardened on it. The structure of the lenses is like that of a pearl, — an aggregation of successive enveloping layers, which are marked on the surface by sets of concentric rings. It is also plain, from these rings, that the lenses are sections, constituting only about one half of the original lenses of the fish, the intention undoubtedly being to produce additional luminous effect by this series of hemispherical reflectors. The crystalline lens of a human eye would not be so large as even the medium-sized lens exhibited, and is so exceedingly delicate that it can only be preserved at all by the greatest care. In many fishes, and especially the cuttlefish (squid), the lens of the eye contains so much solid matter that it will dry up in a short time, and with very little contraction, into a hard, transparent mass, which would probably be durable. On the contrary, Prof. Raimondi, the ethnologist of Peru, believes these eyes to be human, and Dr. Tschudi of Vienna is said to support him in this theory. The region where these mummy eyes are found is rainless, and the mummies were dried in a sitting posture on the salty sand or the nitre beds, often thousands of them at one place. This being the case, they must have been exposed to the public gaze, and the embalmers would naturally wish to make the appearance of the dead as attractive as possible. Hence it is probable that the cuttlefish eyes, which were inserted into the empty sockets, were cut into two nearly equal parts, in order to obtain greater lustre, and give a natural brightness to the eyes of their dead. The three workmen who were engaged in polishing these eyes were all affected soon after working on them. The sawing and polishing were done at different times, and in each case the same result followed, so that the workmen are confident that their illness was caused by the inhalation of dust during the sawing. The youngest, a boy of sixteen, was taken sick after working only a few hours. His illness consisted of headache, biliousness, and vomiting, and lasted for one day. Another workman, a strong, hearty Frenchman, about forty-five years of age, and weighing nearly 200 pounds, reported that he was taken sick with nausea, sick headache and vomiting, and noticed a disagreeable metallic taste in his mouth during his entire illness, which lasted four days. The other, a German lapidary, about forty years of age, shortly after working at the eyes with a pimples over his entire body, and whe affected parts were rubbed, a swelling arose. This rash was perceptible for ov From the fact that these three cases occ workshop, and soon after work was co the eyes, the men very naturally reaso eyes were the cause of their sickness, a a desire not to resume work on them. to inquiry, Professor Baird writes that he that poisonous qualities were inherent If they are really poisonous, it surel from any preparation used to preserve preservative was necessary, as would h case if they were human eyes. It has be however, that, in this case, certain alka generated by the decomposition of the stituents of the eyes. The United S chemists are examining the lenses, to kaloids, if any, are present. As orna eyes are truly beautiful when the exud cut surface has been removed, and th polished. They vary in color from a li amber tint to a dark yellow, yellowish b amber brown, similar to that from Cat In some cases the colors are found i bands, as in the Mexican fire opals from Although the reflections lack the play of in the opal, the tints are warmer and m The lustre on the uncut rounded side With a proper gold mounting these eye a very beautiful effect in jewelry, altho would be likely to injure the polish.

Calendar of Societies.

Biological society, Washingto

Oct. 31. — Col. Marshall McDonald, F necessity for the maintenance of the shad Wm. H. Dall, Deep-sea mollusks and th trated in their development; Mr. Richa Remarks on the Wood's Holl station of t commission; Mr. Romyn Hitchcock, N snow, with exhibition of specimens.

Engineers' club, Philadelphi

Oct. 17. — Mr. P. F. Brendlinger, A no cement testing machine; Mr. John T. 'Coventry' locomotive boiler; Mr. Walt Appliances for landing mine cars at the Mr. A. Marichal. An instrument for at on arcs, of any radii from a few inches to for determining the radii of arcs already

Academy of natural sciences, Phila

Oct. 27. — Carl H. Eigenman, A re American gasterostiedæ; Carl H. Ei Morton W. Fordice, A catalogue of the f Blossom Creek, Monroe co., Indiana; B. and Morton W. Fordice, List of fishe Harvey and Cowley counties, Kansas; man and Seth E. Meek, A revision of species of the genus Gerres; Seth E. Mee Newland, A review of the American sp genus Scorpaena.

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CIENCE.—SUPPLEMENT.

RIDAY, NOVEMBER 6, 1885.

ENT PROGRESS IN POLITICAL ECONOMY.

long been evident to close observers of hought and discussion that the so-called f political economy is in a state of tran- he old authorities have begun to lose on general regard and esteem. Ricardo, and Mill no longer hold the pre-eminent nce accorded to them. Until within a s of Mill's death, the statement might n truthfully made that nearly every t thinker in the field of economics in France, and Germany, was an adherent -called orthodox school of political econ- nomics was regarded as one of the most d severe of sciences, and as having most advanced stage of its development. action began in Germany early in the the rise of the historical school, and so rapidly that German thought was pletely emancipated from the domination authority in this field. The movement er in England; but it had made such efore Mill's death, that even Mill himself n to be influenced by it, and was con- at many of his views were untenable. confessed his conviction that one of his tal doctrines, that of the wage-fund as false, and adopted a very different n its place.

ly and general was the defection in the the orthodox, and so vigorous were the n the stronghold of the faithful, that the on lost all confidence in the scientific of political economy. This was strik- ifested, a few years ago, when a move- started in the British association for ncement of science, to abolish the eco- ction of that body on the ground that no such thing as a science of political

This movement was met, on that oc- y the memorable address of Professor which revealed, for the first time, how y the later thinkers had broken with the . The growing influence of the writings nen as Cliffe Leslie shows how ripe the or a new start in this field, while the blication of the work of the lamented indicates the existence of a school of thinkers in the very centre of Oxford and Cambridge, who are in hearty sympathy with the new movement.

The same tendency to break away from the old moorings is plainly seen among the younger men in this country. It is to be clearly discerned in the tone of newspaper writing done by those who have come under the influence of this new movement. It is evident at all the centres of learning where the modern scientific spirit has been allowed access to this field. It came plainly to light in the organization of the new American economic association formed at Saratoga in September last, where it was clear that the men interested in the enterprise believe that political economy is still in a rudimentary state, and that, if it is ever to attain to the rank of a universally acknowledged science, it must leave the purely abstract and *a priori* methods of the early economists, and have recourse to the same general methods of investigation which have achieved so much in modern natural science.

Perhaps the most striking evidence, however, of the untenableness of the old system, and the imperative necessity for a new, is to be found, not in the attacks of the opponents of 'orthodoxy' in the economic field, but in the present attitude of its defenders. For a time they took almost no notice of the defection from their ranks, or of the growing numbers of their opponents, or, if they did notice it, it was done in that supercilious way which is universally characteristic of conscious infallibility. But a great change has come over the spirit of their dreams. They are now finally aroused, and the result of their awakening is to be found in a series of attempts 'to restate the fundamental doctrines of the science in a less objectionable form.' As a matter of fact, when they get the doctrines fairly 'restated, so as to correspond more closely to the actual conditions of our modern industrial life,' the restatement is so different from the original theory that the latter is scarcely any longer to be recognized in it.

This is eminently true of the little work by Mr. Bagehot.[1] The author examines in the two essays of which the book consists, and which were originally published in the *Fortnightly review*, two of the postulates of the English orthodox school of economics, with the idea of restating them with such modifications as he thought they needed in

[1] *The postulates of English political economy.* By WALTER BAGEHOT. New York, *Putnam*, 1885. 8°.

order to bring them into harmony with the facts of modern society. The postulates selected are those referring to the transferability of labor and capital respectively.

After a short discussion of the reasons for the general neglect into which English political economy has of late fallen, in which he gives nearly all reasons except the right one, viz., that it is an outlived theory, the author proceeds to show that the Ricardian assumption of the easy and rapid transferability of labor and capital among various industries never has been true, and is not true now, though it may be true in the distant future. A more complete vindication of the justice of the attacks on Ricardo's system, so far as it is claimed to be a satisfactory explanation of our modern industrial economy, could scarcely be desired. Had Mr. Bagehot lived to finish the great work of which these essays were to form a part, it can scarcely be doubted that he would have followed out his premises to their legitimate conclusions, and finally have been found where he belonged,— among the opponents, instead of among the restaters, of 'orthodoxy.'

C. R.

TEMPERATURE OF THE MOON'S SURFACE.

Professor Langley's two most important discoveries — 1°, that the greater part of the energy in the solar spectrum is way below the visible red; and, 2°, that our atmosphere is more and more transparent to radiant energy the greater its wavelength — promise to bear fruit in many directions. In his paper on the temperature of the surface of the moon,[1] one of their applications is shown in the complete upsetting of the long-cherished idea that the temperature of the moon's surface rises to 200° or 300° F. during the lunar day, and falls about as far below zero in the lunar night. First enunciated as a theory by Sir John Herschel, the only experimental evidence upon which it has rested has been the observations of lunar radiation by the present Earl of Rosse, to which Professor Langley takes no exception, so far as the experimental results are concerned, but from their interpretation by Lord Rosse, he entirely dissents. This interpretation rests upon the assumptions, 1°, that solar radiation is principally confined to luminous vibrations; 2°, that about 92 per cent of these are transmitted by glass; and, 3°, that only 1.6 per cent of the obscure rays are transmitted by glass. The first has already been shown to be entirely wrong, and, when it is remen that Professor Langley found over two-thi the total energy in the solar spectrum, fi glass prism, to lie below the visible red, n further need be said as to the non-conclusive any deductions from the above assumptions.

Professor Langley's observations on Mt. W lead him to the conclusion that, were it r our atmosphere, the surface of the earth under continuous direct sunshine, would b temperature of only about 48° C. above tl surrounding space (whatever that may be), rate low enough to freeze every thing up perhaps even the gases; and he concludes th moon is in this condition unless it has an ciably absorbing atmosphere, of which the only some uncertain suggestions at present.

Attacking the problem entirely anew, he of its importance as follows: —

"The amount of heat received from the and the dependent question as to the tempe of the lunar surface, are subjects of greater est to us than might at first appear. Th even ones in which we may be said to h material concern, for, until we know the ten ture which an airless planet would attain sun's rays, we can have no accurate knowle the extent to which the atmosphere of ou planet contributes to its heat, nor of so the most important conditions of our ow istence."

Professor Langley describes important im ments in the galvanometer used with his b eter, so that with the combination of the tw now able, when the needle is damped to a of 10s., to make 1mm. on the scale correspon current of only 0.000,000,001,8 of an amp indicate a difference of temperature of 0°.000,016 C. As regards precision of me ment, the probable error of a single observa only about 2 per cent of the total amount of radiation, while in Lord Rosse's work the pr error of *the mean of a series of* 10 *observ* was 19 per cent, thus giving one of the for weight equal to several hundred of the lat say nothing of its far greater freedom fro stant errors.

With this apparatus, and with all the oth finements and precautions against error invariably accompany all of Professor Lan work, he has been making the following in gations: —

1°. Direct measurement of lunar heat com with solar. 2°. Comparison of moon's hea that of Leslie cube (hot water). 3°. Transmi of lunar heat by the earth's atmosphere. Comparative transmission of glass for lunar

[1] Memoirs of the National academy of sciences, vol. iii. pt. i, 2d memoir. On the temperature of the surface of the moon. By S. P. Langley. Washington, *Government*, 1885. 4°.

5°. Observations during a lunar
. Formation of a lunar heat spectrum.
only summarize the results, and they
en in his own words : " While we have
ndant evidence of heat from the moon,
od we have tried, or that has been
thers, for determining the character of
ppears to us inconclusive ; and, without
; that the moon radiates heat earth-
its soil, we have not yet found any
al means of discriminating with such
etween this and the reflected heat that
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ot in the future will probably depend
lity to measure by some process which
a us directly of the wave-lengths of the
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is all, it would be a somewhat discour-
ng, but the best and most important
ote added February, 1885, which we
ll : —

the above paragraph was written, we
eded in obtaining measures with rock-
and lenses in a lunar heat spectrum.
icult measures must be repeated at
tions before complete results can be
but, considering their importance to
t subject, we think it best to state now
terms, and with the reserve due to the
f future experiment, that they indicate
a in the heat curve, — one corresponding
limits of errors of observation to the
e maximum ; the second, indefinitely
n in the spectrum, corresponding to a
ount of heat at a lower temperature.
hat temperature this latter corresponds
e no present means of knowing. We
eded, however, in forming a measurable
rum from the surface of a Leslie cube
boiling water, and the maximum
the lunar heat curve appears to be
maximum ordinate in the hot water
inference from this is, of course, that the
e of the lunar soil is, at any rate, below
ling water, and in an indefinite degree.
nnot close this note without calling
o the remarkable fact that we here seem
dintions from the moon of lower wave-
n from the sun, which implies an ap-
ntradiction to the almost universally
elief that the sun's emanations, like
any heated solid body, include all low
hs representing temperatures inferior
rtainly emitted."

comment is unnecessary. The novelty
tance of the above is self-evident.

H. M. PAUL.

ILLUSTRATIONS OF RECENT ITALIAN PSYCHOLOGY.

THE science of psychology is still somewhat in the position of the young man who has just passed his twenty-first birthday. While really entitled to all the rights and dignities belonging to any of the citizens of the republic of science, yet these privileges are accorded with somewhat of a reluctant spirit especially on the part of the older citizens, who seem rather startled at the notion of receiving, on terms of equality, so very youthful and so very presumptuous a candidate. But now that special professorships in this department have been instituted at several of our universities and colleges ; now that the questions which it discusses find a hearing before appropriate sections of the great scientific associations (for it is scientific psychology alone that is meant) ; that special societies and journals are devoted to the encouragement of its progress ; it may fairly be presumed that whatever of a protest to this reception still makes itself heard is only the echo of by-gone days.

While the greatest part of our experimental knowledge of mind is undoubtedly due to German writers and workers, France and Italy have also contributed much to raise the science to its present position. In France the *Revue philosophique*, of which M. Ribot, whose psychological works are well known to English readers, is the editor, pays special attention to the strictly scientific side of its domain. There has been founded, too, a society of physiological psychology, especially devoted to the consideration of experimental topics. In Italy the *Rivista sperimentale di freniatria*, edited by M. A. Tamburini, and the *Archivio di psichiatria*, etc., edited by M. Cæsare Lombroso, devote much of their energies to another side of the subject. Both the writers just mentioned are deeply interested in the psychology of the criminal and other classes of defectives. The voluminous work of M. Lombroso (Uomo delinquente) is a standard in this line of research. The *Revue philosophique* for September enlarges the circle of readers of some of these researches, by presenting a summary of articles from the two Italian journals. In the hope of still further increasing the usefulness of these contributions to psychology, some account of them is given here.

M. Ferri has made a special study of the religious sentiment in the criminal class, and intends to publish a volume on this subject. He found, in a very large number of criminals examined, only a single one who did not believe in the existence of a God, and most of them belonged to the established church. Many of them are de-

voted to religion, tattooing themselves with religious symbols, asking for God's aid in their enterprises, and thoroughly sincere in their belief that confession absolves them from all responsibility. They are very superstitious; several were found who believed that they expiated their crime by dipping their fingers in the blood of the victim and sucking them, or by wearing the same shirt for a year.

A very excellent example of the connection between the various forms of mental and moral imbecility is shown in the case of a certain Salvatore Misdea, a soldier, whose crime was one of a peculiarly savage nature. He had a prejudice against all Italians who did not come from his own province of Calabria, and imagined that a certain officer had selected his fellow-countryman for punishment just because the latter was a Calabrian. He attacks the corporal, but another soldier, Cordara, interferes. He threatens to chop Cordara's head off that night, but soon everything is calm again. Suddenly a shot is heard and a soldier falls. Misdea enters with a gun, and fires into the crowd right and left. Many try to escape, but he pursues them, and kills the corporal and five or six other soldiers before the gun is wrested from his hands. In prison he was carefully examined by M. Lombroso and Bianchi. They find him to be a crafty, suspicious fellow, with a good deal of pride in his criminal powers. His head was deformed and asymmetrical; the forehead low and poorly shaped, narrow in the temporal region and large above. The right half of the head is more developed than the left; the reverse being the normal condition. Besides, he has epileptic tendencies. His family presents a line of abnormal persons, whose abnormality shows itself in insanity, idiocy, criminality, and general looseness of character. (1.) His grandfather was weak-minded. (2.) Of four uncles, two were imbeciles, a third eccentric, and a fourth killed a friend in a broil; while Misdea's father wasted a fortune on drink, women, and gambling, and his mother was an hysterical woman, who had one brother a brigand and another a sneak-thief. (3.) Of four cousins, two were imbeciles, a third idiotic, and the other insane. (4.) Of four brothers, one was healthy; two were drunkards, one at the same time epileptic; and the other was a violent character. (5.) A nephew also showed bad traits. In spite of all the evidence pointing to his irresponsibility he was condemned to be shot.

This case strongly reminds one of the celebrated criminal family of the 'Jukes' in New York state. There, too, the members of this monstrous family were not all afflicted with the same kind of disease, but weak-mindedness, pauperism, obscenity, thievishness, and burglarism showed themse different branches of the family. This int tion of moral and mental insanity, especi their hereditary forms, has recently been ing much attention. Dr. Maudsley has not great prevalence of moral failings in epilept imbeciles. Kraft-Ebbing, a German a corroborates these observations; and M. Lo has now attempted to describe some bodil liarities common to many of these de classes. He finds that in moral insanity epilepsy the stature and weight are often cent superior to the normal mean. Th generally, too, an asymmetry of the craniu other parts. So, too, in face characteristi leptics show certain peculiarities which a found in persons defective from birth. Th are rounded, the cheek-bones prominen forehead wrinkled, the beard wantin jawbones exaggerated, the face asymmetric forehead low and with a hunted expression the men. Most of these characteristics are in the women as well, who frequently masculine expression. Obtuse sensibility a troubles are common among them. B chief points of contact will always be their p ogy, and for this one must consult the works of Lombroso and others.

The study of the bodily or anthropometri liarities of these defective classes is getting very favorite line of work. Quite an o contribution to this subject is the atte Messrs. Lombroso and Cougnet to detect the of different states of the emotion on the beat. They took the tracing of the sphygm in sad and gay moods. They excited the ous passion, or showed a piece of gold, or of wine, or paid the person a high compl The sexual passion and the glass of wine m the course of the pulse, the money did more, and vanity the most. In short, cri are a very vain class of beings.

The question of bodily asymmetry ha frequently referred to, and is generally reco as an important symptom not only in th measurement, but also in all the properties mon to the two sides of the body. M. Lo has recently measured the local sensibility[1] skin on the two sides of the body in the sa sane, blind, and deaf mutes. In normal the sensibility on the right side is 6 per cent than on the left. In 100 persons there equal sensibility on the two sides in 4

[1] This was done in the usual manner. A pair of points are applied to a definite region and move apart until the subject can just discriminate t points are applied (and not one).

superior, 26; right superior, 29. In criminals, however, the left side is 11 per cent more sensitive than the right; and their sensibility is only 83 per cent of the normal; *i. e.* their sensibility is more obtuse, and the normal relations on the two sides are reversed. In 100 criminals the sensibility is equal bi-laterally in 54; left superior in 27; right superior, 18. One hundred and four insane patients were examined, 43 per cent of whom were more sensitive on the right, 33 per cent on the left side, and 24 per cent were equally sensitive on the two sides. As left-sidedness of this kind becomes more frequent, the difference between the two sides of the body becomes greater. This phenomenon the author calls 'laterality,' and recognizes as a true pathological symptom. In the blind, as in normal people, the right side is the more sensitive, and is as much as 13.5 per cent superior to the left. But their absolute sensibility is 96 per cent of the normal,[1] *i.e.*, slightly less than that of seeing persons. The male blind are more sensitive on the left side, the females on the right. Their 'laterality' and prevalence of left-sidedness allies them to abnormal classes. In deaf mutes the left sensibility is 15.5 per cent better than the right, and their absolute sensibility is like that of the blind, 4 per cent inferior to the normal. Left-sidedness, too, is prevalent.

J. J.

COMPOSITION OF THE WHEAT GRAIN.

THE various grades of wheat flour differ from each other, chiefly as regards the admixture of the outer coats of the grain and of the germ found in the pulverized endosperm which constitutes the bulk of the flour. The problem which M. Girard in his recent book[2] proposed to himself was to separate the grain, not into flour and bran, but into the several tissues of which the microscope shows it to be composed, to determine the proportion of each contained in the grain, to analyze each, and, finally, to determine from these and other data the alimentary value of each tissue and the advisability of allowing it to enter into the finished flour. By very ingenious methods, and the expenditure of much time and patience, he was able to separate, first, the coats of the grain from the endosperm, and, second, the several tissues of the seed coats from each other. The results of this laborious investigation are very interesting, and enable us to form a much more accurate notion of the quantitative distribution of nitrogenous matters, ash, woody fibre and fat among these tissues than was possible before. At the same time it cannot be said that, aside from this, they constitute any very material addition to our knowledge. They show that the 'aleurone layer' is rich in nitrogenous matters, and contains very nearly all of the nutritive substances found in the seed coats, but this was well enough known before.

Of more general interest are his investigations of the nutritive value of the several seed coats, and of their influence upon the quality of bread; but here, unfortunately, a prejudice becomes apparent which detracts seriously from the value of the investigations. The author entitles this section of his book 'Experiments upon the *non-digestibility* by man of the envelope of the wheat grain' (the italics are ours), and he allows this prepossession to lead him into some serious errors in interpreting his results. His digestion experiment (but one was made) was executed upon himself, and, according to his interpretation, showed that but an insignificant proportion of the total dry matter or of the proteine of the envelope was digested. Before the experiment, however, he extracted his materials with water. The amount of matter thus extracted is stated, but it is not counted as digestible, as it evidently should be, because, as the author himself says, "it is evident that they (the extracted matters) would be dissolved in the digestive apparatus."

Correcting this error, and also a gross error in the method of calculation employed for the proteine, we find that there was really digested 22.8 per cent of the dry matter and 35 per cent of the proteine of the envelope, or that it contained 22.8 per cent of total digestible matter, including 6.5 per cent of digestible proteine. Girard's figures are 6.77 per cent of total digestible matter and 0.73 per cent of digestible proteine!

Rubner, in some recent investigations[1] obtained still higher figures, viz., 31.3 per cent of the dry matter, 61.1 per cent of the proteine, and 26.6 per cent of the non-nitrogenous matters; but his figures were obtained by a rather complicated calculation, and refer rather to commercial bran than to the clean seed coats of Girard's experiments. There is no sort of doubt that a not inconsiderable proportion of the seed coats is digestible by man, but, as Girard emphasizes, when calculated upon the whole grain the proportion thus utilized is small, while the quality of the bread is impaired. This is particularly the case with raised bread. According to Mège-Mouriès

[1] This conclusion is contrary to the prevailing opinion. Moreover, the careful experiments of Czermak on blind boys showed very clearly that their sensibility was better than that of seeing persons. It should also be noted that the left side is frequently referred to as the more sensitive.

[2] *Composition chimique et valeur alimentaire des diverses parties du grain de froment.* Par M. AIMÉ GIRARD. Paris, *Gauthier-Villars*, 1884. 67 p., 3 pl. 8°.

[1] Jahresbericht über thier-chemie, xiii. 384.

(quoted by Girard), the envelope contains a soluble ferment resembling diastase, which, during the raising process, at the same time converts starch into sugar and diminishes the elasticity of the gluten, thereby tending to make the bread heavy, while it also imparts a brown color to the bread. Bread made with baking-powder would naturally escape these effects to a large extent.

It is certain that wholesome, palatable bread can be made from whole wheat flour, and, for dietetic reasons, many may prefer it. From an economic point of view, however, it can hardly claim any great advantages, so long as nearly every one can command a mixed diet, and the bran can be profitably utilized as cattle food.

THE ENGLISH SPARROW.

The question of the policy to be pursued toward this bird is fast becoming one of importance; and in many parts of the country stringent measures of extermination are urged by the indignant citizens. A committee of the American ornithologists' union recommended as the result of their inquiries,—

1°. That sheltering or otherwise fostering the sparrow by the public be discouraged, and that its introduction artificially into new localities, and its sale for such purposes, be forbidden by law.

2°. That all existing laws protecting the sparrow be repealed, and that bounties be offered for its destruction.

The states at present protecting this species are Maine, New Hampshire, Vermont, Rhode Island, New York, New Jersey, and Ohio. There are also protective laws in the District of Columbia and Canada. The Massachusetts law has been repealed and specially exempts the English sparrow from protection. The protective law has also been repealed in Michigan.

The earliest known date of importation of the bird is 1858, when Mr. Thomas A. Deblois liberated a few in Portland, Me. These disappeared shortly afterward, and were not successfully replaced until 1875. In 1858 sparrows were liberated at Peacedale, R.I., by Mr. Joseph P. Hazard. They were first introduced into Central park, New York city, in the year 1860. In 1864 twelve birds were turned loose in Madison square, New York city. In 1868 the species was first introduced into Boston common; in 1869, in the parks of Philadelphia; and a little later it became resident at Indianapolis, Ind. In a period of about ten years the sparrows spread through New England and the middle states, and many of the western states, without artificial assistance. In the southern and the western states, beyond the Mississippi River, the bird has not been observed. In Canada become generally distributed over the so sections of Quebec and Ontario, and in 1884 flocks invaded New Brunswick.

The bird is evidently spreading itself w treme rapidity, which should be expected bird that hatches from three to four br four each in a single season.

In regard to the food of the sparrow, littl to be settled except that it prefers vegetab to animal, but will eat insects if driven to is capable of doing great injury to grain, a great pest to fruit-raisers. I have seen fl them in cherry-trees doing far more mischi the robin, and I have seen them in early nip off the young buds of peach-trees v any apparent reason, other than a desire n idle. Seeing that they did not appear to buds, I killed two to see their reason f destruction. I found nothing in their st except crumbs that had been fed then morning.

The bird has little to recommend it, is dirty, and disagreeable both to man and t birds; and there is every reason why we do in this country as it has been found ne to do in others,— enact laws looking to their mination.

Ralph S. T.

THE EFFECT OF THE SETTLEME NORTH AMERICA UPON ITS ANIMALS.[1]

The common deer was abundant from l to Canada, throughout the eastern half United States, when Europeans first settled part of North America. It is now restricted sparsely-settled forested portions of this ar is rapidly decreasing in numbers. The ' e wapite, ranged throughout temperate North ica as far east as the Blue Ridge. For man it has been wholly extirpated east of the Plains and in the Rocky Mountains, and in west generally is rapidly approaching exti The moose and the caribou have been driven ward in New England and southern Can still unsettled forest regions; while the formerly ranging in considerable herds ea to the Alleghanies, and occupying the Great in countless numbers, is now practically exti a few small bands, remotely scattered, and bering a few dozen individuals each, const the insignificant remnant of the millions th than twenty years ago, covered the Plain Texas to the Saskatchewan. The prongho

[1] Condensed from an article by Ernest Ingersoll, Amer. geogr. soc., 1885, No. 1.

the black-tailed deer have suffered great restriction in area of habitat, and have greatly decreased in numbers. The mountain sheep and mountain goat, delighting in the rocky fastnesses of alpine summits, well-nigh inaccessible to man, still bid defiance to human foes, although the former has been driven from much of its former range. At the present rate of destruction, only a remnant will soon remain of any of the ruminant tribe, even in the comparatively unsettled west, though formerly they overspread the greater part of the continent.

The larger carnivorous mammals—as the bears, the wolf, the coyote, the lynxes, and the panther, formerly so abundant throughout the parts of the country they respectively inhabited as to be at its first settlement obnoxious, and a serious detriment to the farmer and stock-raiser—are now practically exterminated east of the Rocky Mountains, and thence westward are rare in comparison to their former abundance. This is especially true of the wolves, the coyotes, and the panthers: the bears and the lynxes still maintain a foothold in the partially wilderness areas of the east.

The fur-bearing animals—as, notably, the beaver (formerly a nearly universal occupant of the continent), the otter, the sable, and the mink—have greatly decreased in numbers, all but the latter having been long nearly extirpated throughout all the more settled portions of the east. The sable, a northern species, never ranged over a very large part of the United States, but the others were spread southward to the Gulf. The squirrels, at times a scourge to the frontier farmer through their abundance, linger still in small numbers; while the smaller vermin of the fields have doubtless suffered but slight decrease in numbers.

The birds are variously affected, in accordance with their food and haunts. The larger forest-haunting species—as the birds of prey, the woodpeckers, and some of the grouse—have followed the forests in their downfall; the turkey, the prairie-hen, and the aquatic game birds—as the ducks, geese, and a great variety of shore birds—have in places been extirpated, and, in general, are few in comparison to their numbers a century ago. The song-birds have doubtless held their own, and in not a few instances have certainly increased; the agricultural development of the country being, on the whole, favorable to their welfare, although they suffer at the hands of nest-robbing boys, and children of larger growth anxious to kill something, however slender the pretext. The graceful terns, or 'sea-swallows,' and the herons, especially the beautifully-plumed egrets, have fallen a prey to fashion and the 'hat trade' to such an extent, that where, fifty years ago, the terns fairly swarmed along our Atlantic coast, they are now mainly conspicuous by their absence.

Batrachian and reptilian life has also greatly diminished; the former through the draining of ponds and marshes in the reclamation of waste lands, the latter through the almost universal inborn hatred of snakes.

The depletion of our inland streams and lakes and the larger rivers, of fish, is simply notorious, extending even to the marine species that enter the rivers merely to spawn. Nor has marine life fared better, as witness the decline of the lobster fisheries, the actual and very early extirpation of the oyster along our northern coasts, and the exhaustion of once famous clam-flats.

Much of this destruction of animal life was simply inevitable, since wild large game cannot exist in a densely-populated district. But extirpation has been in many cases needlessly hastened, as witness the preservation of deer by legislative enactments, in regions where they would otherwise have long since ceased to exist. The course of the pioneer has ever been marked by slaughter of animal life, too often recklessly, even for the mere sport of killing, and not merely from necessity or with utilitarian intent. Hundreds of thousands, probably millions, of bisons have been killed merely for their hides, and at seasons when they were nearly worthless, and their carcasses left to rot where they fell, and many thousands more merely for the sport of slaughter; while the different species of the deer tribe have suffered similarly, in less degree, consequent only upon their smaller numbers and greater difficulty of capture.

ADMIRAL BARON FERDINAND VON WRANGELL.

FERDINAND VON WRANGELL was born near Werro in Liefland, December 29, 1794. His early years were passed on his ancestral estate, where his education in manly sports and the schooling of his time was carried on by a family tutor. At the age of ten he lost his parents, who died within a few months of one another. He entered not long afterward the school of naval cadets at St. Petersburg, with his cousin Wilhelm, and was graduated in 1815 with the highest honors. He was appointed to the post of Reval, where he was associated with his cousin and von Anjou, an intimate friend, later his companion in Siberian travel. Hearing that a Russian vessel was to sail for a voyage around the world in command of Captain Golofnin in 1815, he secured an appointment and formed one of the party on the naval sloop Kamchatka, which included the young and

afterward celebrated Lütké. The vessel sailed for Russian-America in 1817, and completed her voyage in two years, when he was promoted to a lieutenancy, after which, through the influence of Golofnin, he was appointed leader of the expedition for the exploration of the east Siberian coast and the lands believed to lie to the north from it. For this journey, which has become classical, he prepared himself by special study at Dorpat and St. Petersburg. He went out in 1820 and returned to St. Petersburg in 1824. In 1825 he took the brig Krotky on a voyage to Sitka and return, after which he was appointed to the command of a frigate, and in 1829 to be governor of the Russian colonies in America. He married the Baroness Elisabeth Rosaillon, and the young pair started for his new post by the overland route across the whole breadth of Siberia. The journey, severe at the present day, was an extraordinary one for that time, and took a year and a half, during which time a daughter was born to them. Arrived at his post, Wrangell distinguished himself by the reforms he introduced into the colonial administration, and the wealth of scientific material which he gathered for students of geography and ethnology. They returned via Mexico and the United States in 1830. He was made a director of the Russian-American company, and advanced in the government to the post of director of naval construction and conservator of the imperial forests. In 1852 he lost his faithful wife. During the Crimean war he was made director of the hydrographic department, and in 1862 retired from active service. His life thereafter was passed in the bosom of his family, either in his old home or in Italy, where he remained several years. He was made associate of the Institute of France as successor to De Candolle, and his latter days were passed in the study of art, science, and the promotion of the Lutheran communion, of which he was a devoted member. On the 25th of May, 1870, he died, his friend Lütké surviving him eleven years. His services to science do not need to be recounted, his character was pure and elevated, and his executive ability remarkable. The sketch of his useful and honorable life from which the above facts have been gathered, has been prepared as an introduction to a new edition of his 'Journey to the polar sea,' by his daughter, Lisa von Engelhardt. This publication, indispensable to all students of arctic matters, contains an excellent portrait and a new map of the region explored. It is well printed in Roman type, but contains no index. We note as a singularity that, notwithstanding Baron Wrangell expressly authorized his associates, Baer and Helmersen, to put his name with the final consonant doubled, in the publication it is found without the final *l*.

[1] Ferdinand von Wrangel's Reise längs der nord-küste von Sibirien und auf dem eismeere. Von L. v. Engelhardt. Leipzig, Theodor Thomas. 1865.

A SEARCH FOR THE GIGANTIC BIRD OF MADAGASCAR.

Grandidier has communicated to the Academy of sciences an interesting account of his search for remains of the gigantic bird of Madagascar, the Æpyornis, supposed to be the original from which the fabled roc of the 'Arabian nights' was derived. The hope that the bird itself might still survive, according to Grandidier, is without foundation. A vast area of the interior south of Lat. 23° S., heretofore hardly visited, now proves to be an arid plateau with sparse desert vegetation, suitable perhaps for ostrich-like birds, but where they could hardly exist without being observed even by the scanty population of these wastes. The natives have neither knowledge nor traditions of any such creature, according to our author. Remains, chiefly of the eggs, have hitherto been found only between Cape St. Marie and Machikora on the southern coast, at Mananzari, Port Leven on St. Marie Island. The coast is bordered by immense sand dunes, only a few yards from the sea which are constantly advancing in a southwesterly direction. The complete eggs have been found only where rain, flooding the ravines, has suddenly washed away large quantities of sand. It is probable that the bird covered its eggs in the warm sand like an ostrich, and that those found whole are such as failed to hatch. They are extremely rare, but fragments of the egg-shell are not uncommon and occur chiefly where the sand is shifted by the wind. On the dry plateau none were found. With the pieces of egg-shell were found several species of Bulimus, Helix and Cyclostoma, one of which, Bulimus favanneus Fér., still retains part of its color marks, and is found living in some parts of Madagascar at the present day. The dunes appear to be formed largely of shell sand mixed with grains of quartz, and occasional stalactitic balls of lime. The traveller was not fortunate enough to find any bones. He thinks the Æpyornis, like the moa of New Zealand, though now entirely extinct, existed during the present era, and was probably exterminated very soon after the advent of man in the region it inhabited.

— Mr. Latchford of Ottawa recently has been at Quebec. Helix cantiana Montagu, hitherto recorded from America. It is [illegible] importation, but was abundant under the north wall of the citadel, showing that, like many other immigrants, it has found a congenial home.

SCIENCE.

RIDAY, NOVEMBER 13, 1885.

COMMENT AND CRITICISM.

ATIONAL ACADEMY OF SCIENCES is holding an session at Albany as we go to press. ber of papers read at these autumn s, which are held now in this city, now never so great as at the spring meetings Washington; but the quality if not the of papers is apt to be equally good, since n is called, except for specific reasons, purpose only. The session at Albany em to be no exception to the ordinary although there is but a single member of emy resident in the city, — the veteran Prof. James Hall, — the attendance has insignificant, nor the meeting lacking points. Besides the usual papers of nical importance, there have been a f very general interest, prominent among e those of Prof. E. C. Pickering, opening ay fairly be looked on as a new and g field in astronomy, that of stellar phy; the paper of Prof. S. P. Langley on heat, a continuation of his remarkable s with the bolometer; that of Dr. Graham unting the first fruits of his investigation influence of heredity in deafness; and Prof. Simon Newcomb, discussing the estion at what hour the astronomical day in. In our next issue we hope to present nt of the entire meeting.

EPLY of Director Powell, which we pub- nother column, to the newspaper attacks geological survey, will strike the fair- reader by its conclusiveness. It is true prosecution, if there were any, would still e right to prove its allegations by rebut- lence; but the very fact that the reply of nce is couched in such terms as to make it do this, renders it doubtful whether any dence will be forthcoming. The director enter into any long explanations, requir- exhaustive inquiry into their validity, but e important cases interposes a direct denial allegations have any foundation. The issue is thus brought down to one of easily ascertained facts, which it would be impossible for the director to pervert without speedy exposure. For example, it was distinctly charged that he had paid salaries as high as $4,000 per year to state geologists. He replies that the name of every geologist employed by the survey is a matter of published record, and challenges the accuser to show that any one of them is a state geologist. For more reasons than appear on the surface, our government science is to be congratulated on the completeness of the defence.

The case has some peculiarities, which render it noteworthy that the director should have been able to vindicate himself so completely, in the face of such an attack. Rarely has a government officer been intrusted with so large an annual expenditure, so completely at his own discretion, as the officer in question. The organization, under which the work was to be done, was largely his own creation, and the funds had to be expended in distant parts of the country, through agencies not in personal contact with the supreme power. Just as the system has been got well into operation, searching investigation is commenced. The disaster which overtakes a sister institution, when exposed to such scrutiny, leads to the confident expectation that this one may also be found wanting in some point, when searched by eagle eyes. That some errors in detail would be found, might almost be taken as a matter of course, and in such a case the extraordinary character of the circumstances might have been plead as a valid excuse for many such errors. And yet the latest report is that the vigilant first auditor has found no fault in the legality of any of the expenditures of the bureau, and finds all the accounts in good shape.

THE CASES OF POISONING at Momence, Ill., recorded at length in a report just issued by the board of health of that state, are of great interest as bringing to light a source of danger hitherto but little regarded. In the course of the investigation it was found that the thirty-seven individuals affected had all eaten of dried beef purchased from the same butcher; of the number seized with the symptoms of poisoning, but one died. Although

trichinae, or some other form of parasite, was at first suspected, the microscope gave no clew to the cause of the sickness. Chemical search for the ordinary mineral and vegetable poisons was also fruitless, but further examination left no doubt in the mind of the investigators that ptomaines were responsible for the trouble. Ptomaines derive their name from *ptoma* ('a corpse'), and were so called because first discovered in a corpse. Selmi, in 1870, while examining the body of a man who was supposed to have been poisoned, found an alkaloid totally unlike any which had been described. Gautier and others, working on the same problem, have demonstrated that, during putrefaction, certain substances are formed, variously described as 'ptomaines' and 'cadaveric alkaloids,' which are peculiar in themselves, and which have poisonous properties. It is probable that the dried beef purchased in Momence had previously begun to putrefy, and these poisonous substances were formed. The fact that several of those affected noticed a bitter taste to the meat would confirm this opinion. It is a fact which has not received the attention it deserves, that in many of the reputed cases of poisoning from dietary articles, disagreeable, peculiar, or bitter tastes are often noticed by the patients, and that those who are wise enough to take the hint which nature thus gives them, and at once refuse to partake further of the article in question, usually escape; while the others, who neglect this warning, suffer. This has been noticed in poisoning by canned tomatoes and apples, as well as by meat.

THE RECENT STUDIES upon the movements of anadromous fishes in our Atlantic rivers and estuaries, the results of which are in part announced in another column, are of considerable moment from several points of view. Much has already been written in a theoretical way concerning the influence of temperature upon the migrations of fishes, upon their times of spawning, the period of hatching, and their rates of growth. The literature of the subject has not, however, been entirely satisfactory, since a definite correlation of observed fact with explanatory hypothesis has rarely been attempted. The same may be said of the literature of fish-culture, which has been to a considerable extent prophetic in character. One of the most important of recent conclusions is that fishes do not of necessity always return to spawn upon the grounds where they themse first left the egg, but that slight variations of t perature are sufficient to divert a school of fi from any river-basin into another. An impor practical conclusion is at once suggested; nam that the success of fish-culture in any hydrogra basin is so dependent upon similar operation adjoining waters, that co-operative action of states is absolutely necessary, either through agency of the general government or by comb tions between the state commissions. It is g fying to know that the mass of water-tempera records which has for fifteen years been a mulating through the labors of the United St fish commission, the signal service, and the li house board, has at last become sufficiently g to afford data for the comparative study of p odical averages. All students of marine zoö will profit by the study of these tempera tables, which, we are informed, are soon t published. The rapid advances which are being made toward the elucidation of the life tories of American fishes lead us to hope that time is not very remote when our knowledg the phenomena of marine life shall be made n definite in character than at present.

THE ATTEMPT TO ESTABLISH a zoölogical gar in America after the plan of those already in e: ence in Europe was a novel and interesting on the time that the Philadelphia zoölogical soc was organized. The garden was opened under most favorable circumstances. The popular se ment was successfully appealed to, and during centennial year the garden received a fair shar the public patronage. But the favor which tended the beginning of the enterprise has continued. The society has been conducted : loss for several years. The anticipated deficit the current year is seven thousand dollars, amount so large as to induce the directors to vite the citizens of Philadelphia to meet to hea statement of the society's affairs, and to disc measures for their relief. At a representat meeting of the citizens, held November 5, it v quickly discerned that the garden of the soci had a firm hold on the affections of the peop There appears to be no doubt that a successful eff will be made to meet the year's deficit, and devise means by which the society can be plac upon a permanent basis. The management zoölogical gardens in America will be found to

a different problem from that of their European progenitors. An interest in zoölogy is with us less diffused than is the case abroad, the climate is less favorable for out-of-door recreation, the gardens are at great distances from the centres of population, and the cost of securing many of the larger and more interesting animals is great in proportion as the gardens are removed from the chief places of traffic. The zoölogical garden in this country is not likely ever to be self-supporting. Whether or no the zoölogical garden should have a plan of organization distinct from that of the botanical garden is a mooted point. It would appear that there is nothing inconsistent with the idea that the plan of the learned society or the university might readily embrace that of the management of a collection of living animals. Were such an arrangement practicable, it would enable the garden to be benefited by the use of the general endowment of such bodies, while it would not interfere with the popular uses of the collection.

NOTWITHSTANDING THE FACT that the whole civilized world is interested in the subject of the transfer of ships across the narrow neck of land which separates the Atlantic and Pacific Oceans, by which the long voyage around Cape Horn would be avoided, yet there has been no project proposed or suggested which has met with less favor in the minds of engineers of high standing, at least in this country, than the Panama Canal. The magnitude of the enterprise, the formidable engineering difficulties to be encountered, the unhealthiness of the climate, and the fact that the undertaking is a private one, depending on private subscriptions, constitute obstacles which, when taken together, seem to render success almost hopeless. The recent call for more money to carry on the work, when the most costly and difficult portions have hardly been begun, and after vast sums have already been expended, must awaken grave apprehensions on the part of those who have already invested their money in the enterprise, that the project is beyond the financial abilities of the most powerful syndicates.

AS THE INCOME of the Elizabeth Thompson science fund is already available, the trustees desire to receive applications for appropriations in aid of scientific work. This endowment is not for the benefit of any one department of science, but it is the intention of the trustees to give the preference to those investigations, not already otherwise provided for, which have for their object the advancement of human knowledge, or the benefit of mankind in general, rather than to researches directed to the solution of questions of merely local importance. Applications for assistance from this fund should be forwarded to the secretary of the board of trustees, Dr. C. S. Minot, 25 Mount Vernon Street, Boston, Mass., and should be accompanied by a full statement of the nature of the investigation, of the conditions under which it is to be prosecuted, and of the manner in which the appropriation asked for is to be expended. The first grant will probably be made early in January, 1886. The fund was originally given by Mrs. Thompson, as will be remembered, with the expectation that it would be administered by the officers of the International scientific association proposed at the Philadelphia meeting of the American association. This proposition was to have been brought up at the Aberdeen meeting of the British association; but, so far as known, no action was taken. The fund is now in the charge of the able body of trustees already named, (*Science*, vi. 144), and will doubtless prove a great aid to American science if the best investigators will ask for appropriations from the income. It is a severe comment upon the physicists of the United States that the income of the similar fund established by Rumford for investigations in light and heat should go begging as it does.

THE AGASSIZ MUSEUM AT CAMBRIDGE.

THE day after his twenty-third birthday, Agassiz wrote from Munich to his brother, "The thing I most desire seems to me, at least for the present, farthest from my reach; namely, the direction of a great museum." He lived to see the Museum of comparative zoölogy, which he founded on another continent, the largest collection, covering the whole field of natural history, ever brought together by the endeavors of a single individual. Reckoning from the inauguration of the first section of the building, to-day completes its quarter centennial, and renders appropriate a succinct account of its inception and growth, largely in the words of his son, Dr. Alexander Agassiz, when addressing, last spring, the friends of the institution at the opening of the latest extension of the building.

The recently published 'Life of Agassiz' shows us that his passion for acquisition was enormous from his youth. Wherever he went, his collections in natural history accumulated to a burdensome degree; and, although he left every thing behind him

when he came to this country, ten years had not passed before he had here amassed collections not only from America, but from all parts of the world, which it would stagger many a university to support. Yet his aim was, not to found a museum which should be a mere accumulation, but one that "should have a well-combined and clearly expressed educational value." The bequest of his friend, Mr. Francis C. Gray, in 1858, of fifty thousand dollars, was the initiation of the final enterprise; and when the new institution was inaugurated, two years later, it possessed, besides the Gray fund, a building erected by private subscription to the amount of over $71,000, a fund of $100,000 granted by the state through the personal exertions of Agassiz, and the collections obtained by his indomitable zeal.

The bequest of Mr. Gray, quadrupling itself in two years, did not find Agassiz unprepared. Indeed, it was the knowledge of plans, to the utmost details of which he had devoted years of thought, that had moved the gift of his friend. He would have the museum represent in each department the sum of our information in special zoölogy, comparative anatomy, embryology, paleontology, and zoölogical geography. He would have it illustrate at once the structure and mode of growth of animals, their order of succession in geological times, and their geographical distribution upon the surface of our globe; the relations between the animals of past time and those now living, and between the law of succession in the former, and the laws of growth and distribution in the latter.

"A museum founded upon a comparative study of living and fossil animals in connection with their embryonic changes and their geographical distribution could no longer be called simply a zoölogical museum," said Agassiz in his inaugural address: "ours is a museum of comparative zoölogy."

How large his expectation was may be seen by what he wrote as early as 1858:—

"My hope is that there shall arise upon the grounds of Harvard a museum of natural history which shall compete with the British museum and with the Jardin des plantes. Do not say that it cannot be done, for you cannot suppose that what exists in England and France cannot be reached in America. I hope, even, that we shall found a museum which will be based upon a more suitable foundation, and better qualified to advance the highest interests of science, than these institutions of the old world."

By a strange coincidence, the foundation of the museum dates from the publication of Darwin's 'Origin of species.' Of course, so powerful a movement in the scientific thought of the time could not fail to modify the problems which t institution was intended to illustrate and to sol Yet the usefulness of the plans laid down for t museum remains unimpaired by the new meth of treating questions of affinity, of origin, of g graphical and geological distribution. Should t synoptic, the systematic, the faunal, and the pa ontological collections cease to bear the interpre tion given to them by the founder, their inter and importance, even for the advocates of the n biology, would not be one whit lessened. If t anatomical, embryological, synthetic, and oth series presented by the pupil of Cuvier from point of view, are differently considered to-day the followers of Darwin, they may, for this ve reason, have gained a general interest they did formerly possess.

The plans of the founder have been realiz perhaps, far beyond his most sanguine expec tions; and it has been reserved for his immedi successor to see the establishment of a prosper school of natural history, amply provided w laboratories, connected with a university, a recognizing in the administration of its trusts t claims of the college and of the advanced s dents, as well as those of the original investigat Nor has it neglected the interests of specialis but has accumulated extensive collections, co veniently stored, and easily accessible to all w are able to make a proper use of this material.

The publications of the museum (eleven volum of bulletins, and thirteen of memoirs) give, wi the addition of the monographs thus far issued workers at the museum, a fair idea of the fie covered by its various departments, though th do not sufficiently represent the original wo done by the teaching staff of the university a its students.

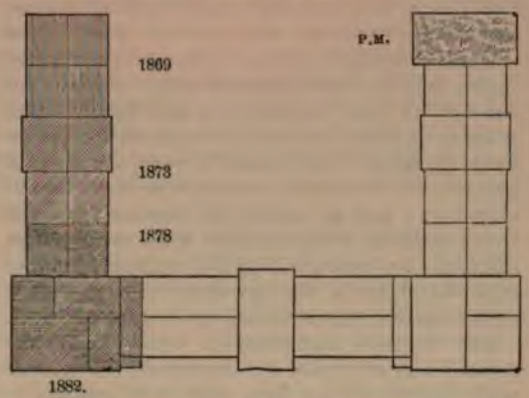
The library has grown from a few hundr volumes to an important collection of biologic works, numbering over 17,000 volumes, exclusi of pamphlets and of the Whitney library.

In 1860 the building covered a space eighty sixty feet, and it contained, in all, sixteen room used as lecture-room, laboratories, store-rooms, a exhibition-rooms. A visitor to the museum those early days would now find it difficult to re ognize the rooms or their contents in the prese arrangement. During the early years of the ins tution, every thing had to be sacrificed to t exigencies of the rapidly accumulating collection But the difficulties involved in so large an unde taking prevented Professor Agassiz from fair developing his schemes; and it became evide at the time of his death that only a radical r arrangement of the collections could give distin expression to his plans.

The ground covered by the building as it stands to-day is five times as great as in 1860. There are no less than eighteen exhibition-rooms, with their corresponding galleries, of which eleven are open to the public. Thirty-two rooms are used for storage and quarters for special students and assistants. There are also a lecture-room twice the size of the former, a curator's room and office, eleven laboratories of biology and geology for college and advanced students, four rooms devoted to the library, and in the basement, in addition to boiler space, rooms intended as an aquarium and vivarium and for receiving freight; making, in all, seventy-one rooms and twelve galleries. These rooms are all comparatively small, mostly 30 by 40 feet, no attempt being made at exhibition-rooms imposing from their size. All are not yet complete, but the space now devoted to the different classes of the animal kingdom, zoölogically arranged, contains all that will be given for public exhibition, no matter how extensive the collections may become; for limited collections carefully assorted are far more intelligible to the general visitor than larger and more indiscriminate ones; the visitor sees only one thing at a time, and is not bewildered by room after room or case after case of specimens which seem to him to have no meaning.

In the 'synoptic' room, centrally placed, a favorite scheme of Professor Agassiz, the visitor will get an excellent idea of the great types of the animal kingdom, unencumbered by a mass of detail. He may pass thence to one of the 'systematic' rooms, of which there are five, devoted one each to mammals, birds, fishes, mollusks, and to radiates and protozoa, with their galleries devoted to reptiles, insects, and crustacea. Following these, he will turn to the 'faunal' rooms, — one each for North America, South America, Africa, India, Australia, and Europe-Siberia. To study the birds, for instance, he will visit not only the room devoted to the illustration of their zoölogical affinities, but the several faunal rooms, where he will find the birds characteristic of each province, repetitions being as far as possible avoided. This plan obviates the crowding together into one space of the whole collection of birds, which merely satiates the visitor, and teaches him little. Two other rooms, not yet opened, will be devoted to the marine faunas, where the geographical and bathymetric distribution of the animals of the Atlantic and Pacific will be shown. A similar double plan is contemplated for the fossils, to which four exhibition-rooms will be devoted.

The original plan of the museum contemplated a main building 364 feet long by 64 feet wide, with wings 305 feet long and of the same width, built as in the accompanying plan, in which the section in vertical lines represents that first constructed; that in oblique lines, the portion added before the death of Agassiz; and that in crossed lines, the



additions at two successive periods since. The portion on the right, in broken lines, was given over to the Peabody museum of archeology. At the time of the death of Professor Agassiz, the buildings and collections represented an expenditure of about $200,000, and the invested funds amounted to about $185,000. The invested funds now amount to more than $580,000, while the additions to the building and collections since that time represent an additional expenditure, besides the running expenses of the museum, of more than $500,000, — an amount very largely due to the unstinted generosity and filial devotion of the present director.

Witnessing this enormous growth, Mr. Agassiz looks at the future with no small concern. He would hold fast to what has been gained, but hesitates to commit himself to any further rapid advance in the same direction, believing that the limits of a university organization for such an institution have already been reached. While it is undoubtedly capable of indefinite expansion in the way of endowments for special professorships and assistants, it is doubtful if it be wise to expect or aim at any expansion beyond that which naturally comes from the demands of endowed chairs in a university. Original investigation has always been best promoted in connection with educational institutions; and museums should grow in conformity with their demands, and no faster, unless they are to become mere unwieldy and meaningless accumulations.

If the material growth of the past is to continue, the resources of the institution, large as they are, will soon be entirely inadequate. An attempt has therefore been made to combine the work of assistants and that of investigation, in order that the resources of the museum may keep pace with

the ever-increasing specialization in the different branches of natural history. More than that, the conditions and opportunities for special work have greatly altered in this country within recent years. Other large museums have been founded or more abundantly endowed, while a large part of the original investigation of to-day must be carried on in the field on fresh material which no museum can furnish from its stores. It therefore becomes wiser to abandon the accumulation of vast collections, excepting such as may be cared for at small expense, wherever these are certain to be duplicated elsewhere; and to expend the income from the funds rather in fostering such work as may most efficiently be conducted by the professors holding endowed chairs in the university, and by the assistants in the various departments of the museum.

The boldness and decision with which Mr. Agassiz here advocates a policy utterly at variance with that which has been heretofore pursued, is worthy of the most careful attention of all who have to deal with museums. From his position at the head of an extensive establishment, in which he has complete control, and which he has himself largely endowed, he occupies an unequalled vantage ground. He has cut completely adrift from the traditional notions of what a great museum should be, while adhering rigorously to the exhibitional features impressed upon the museum by his father. In this we believe he has struck the keynote of what is needed for a university museum in this country, and what the requirements of modern science demand. We commend his views to all who have to deal with the expensive problem which natural history museums force upon the attention.

ANSWERS TO CHARGES AFFECTING THE GEOLOGICAL SURVEY.

Secretary Lamar has received from Major J. W. Powell, director of the geological survey, a letter, of which the following are the most important portions:—

Various charges affecting discreditably the administration of the geological survey have been current in the newspapers of the country for the past four months, and I deem it my duty to call your attention to the same, and to append brief statements to them severally, that you may see how baseless and absurd they appear in the presence of the truth.

It is charged that the survey has been extended into the eastern portion of the United States in violation of law. The law specifically provides that the survey shall extend over the entire United States, and the law was passed after repeated and lengthy debate in congress by an overwhelming majority.

It is charged that the geological survey is duplicating the work of the coast survey and of state geological surveys. There is no truth or color of truth in the statement.

It is charged that a corrupt conspiracy existe in the National academy of sciences to break dow the old organization for geographical and geolog cal surveys in order to create the new; that th National academy itself had little to do with thi but that the conspiracy was the work of a corru committee. In an act of congress approved Jun 20, 1878, the academy was required to report to co gress a plan for making a topographic and geolog survey. Such plan was reported, and the presen geological survey exists in pursuance of that pla under specific statutes passed by congress. Th committee of the academy that considered th subject was composed of Profs. O. C. Marsh James D. Dana, William B. Rogers, J. S. Ne berry, W. P. Trowbridge, Simon Newcomb, an Alexander Agassiz. The plan was reported b the committee at a meeting of the academy calle for the purpose of hearing the report, and wa discussed at length in the academy, and adopte unanimously.

It is charged that the scientific men of th National academy of sciences, in wicked collusio with Major Powell, "proposed to wipe out the lin which now fix the limits of all lands sold from th public domain of the entire country, and introdu a new system." There is no truth and no color truth in the statements; its falsity is equalled on by its absurdity.

It is charged that Major Powell was elected member of the National academy of sciences b corruptly distributing patronage to its member Major Powell was elected to membership in th academy prior to his appointment as director the U. S. geological survey, and at a time when h had no patronage under his control to be use with the members of the National academy.

It is charged that the publication of th geological survey is not germane to its work and Packard's 'Report on geometrid moths' given as an illustration; and it is stated tha nearly all the publications of the survey are of th same class. This work of Dr. Packard's was n published by the U. S. geological survey, but b what was known as the Hayden survey years ag The law now prohibits the publication of gener works on natural history by the survey, an confines the publication to works germane t geology and geography.

It is charged that "Major Powell has a fondne for state geologists. Now, if Powell can ge

ologist $4,000 a year, as he does in several e geologist is so much better off." No ologist has ever received a cent of salary e U. S. geological survey. In connec- h the above charge, the names of all logists and assistant geologists in the l survey are given, together with their and the statement is made in such a s to make it appear that they are all state s, when, in fact, not one of them is em- y a state.

harged that Captain Clarence E. Dutton, rdnance corps, receives his salary as cap- he army, and also a salary as geologist in ogical survey. Captain Dutton receives y as captain in the army, but does not salary as geologist; and his detail as an n the geological survey is made under y of a specified act of congress, and his s been extended by the present secretary

harged that collections of fossils which ne instance $50,000, and in another $100,- ead of being deposited in the national , have been diverted to the private muse- Professor Marsh of Yale college, and Pro- pe of Philadelphia. The geological sur- fossils in the hands of Professor Marsh of lege. It also has fossils in the hands of Newberry of New York, Professor Fon- the University of Virginia, Professor Philadelphia, and various other persons ut the United States. The collections of gical survey are sent to specialists for mination, and the statute organizing the l survey contemplates this by providing n the specialists have finished their work llections, they shall then be deposited in nal museum.

arged that $112,000 was paid out for sal- xcess of the amount appropriated for that last year. There is no truth, or color of the statement.

CRUISE OF THE CORWIN.

interested in arctic matters will recall the afforded by a modest octavo report, issued evenue marine bureau in 1881, on the ex- s of the Corwin during the season of 1880. wing year the officers of this gallant little em to have outdone themselves, and, variety of creditable explorations, had of being the first civilized men to set foot on Wrangell Island, afterwards more completely surveyed by the officers of the U.S.S. Rodgers. This land, first reported by the Chukchi to Russian traders, was first seen by Kellett, who saw the tops of the highest land, and called it Plover Island, located it erroneously, and, having reported much more land which was only mirage, his whole discovery fell into discredit, if not oblivion. The land was first accurately described, named, and located clearly, by Capt. Long, of the whaling fleet, who did not land, — an honor reserved for Hooper and his party, and afterward for the Rodgers party.

The present report gives in detail an account of the voyage, and is profusely illustrated by cuts in the text, of a not very accurate or always useful kind, and a number of heliotypes from photographs made by Nelson. These are poor, considered merely as pictures, for the difficulties under which they were taken were great; but intrinsically they are extremely valuable. They contain portraits of numerous Innuit, Tsau-chu (or Chukchi), and ethnological objects of special interest. The text contains much that is of interest to the general reader, but is less useful to the student than the small report of the previous voyage. Probably nothing was farther from Capt. Hooper's mind than the idea, that, by incorporating material from other sources, he was doing an injury to his report. It is quite true, however, that in many cases it is impossible to determine whether a given statement is the result of personal observation by himself, or an inference from the observations of others; and the value of the work as a contribution to knowledge is seriously impaired by this state of things. There is some hasty generalization, and rarely a distinct error, as in the statement that the Asiatic Innuit have entirely disappeared except at East Cape (p. 100). It is well known that they have not disappeared, and are not likely to, and that the short stay of the Corwin party at any one point often did not enable them to learn to which of the two races their casual visitors belonged. The long delay of publication, also, has made some of the statements obsolete, especially in regard to currents, which Capt. Hooper discusses at some length, and comes to conclusions which would be to some extent modified, if reviewed to-day.

The birds, fishes, etc., were treated by Nelson, Bean, Rosse, and others, in a publication which appeared some time since. In the present volume are some useful meteorological summaries from Nelson's note-books, and a characteristic effusion on glaciers, by John Muir. This gentleman's devotion to glaciers and their work is sufficiently well known to American geologists to need no serious attention here. Foreign readers, however,

f the cruise of the U.S. revenue steamer Thomas the Arctic Ocean, 1881. By Capt. C. L. HOOPER, commanding. Washington, *Government*, 1884 p., illustr., 16 pl. 4°.

may be benefited by the reminder that other observers, including some of Mr. Muir's companions on the trip in question, have been unaccountably blind to the remarkable phenomena upon which some of his far-reaching conclusions seem to rest.

Such records as this volume affords, in spite of minor defects, are most creditable to the bureau and its officers; and it is to be hoped that the series may be indefinitely continued.

NEW BOOKS.

*** For full titles see 'Publications received at editor's office.'*

'THE perfect way in diet' (Kingsford) is a translation of a thesis presented, in 1880, by the author, for her degree of doctor of medicine, and is a plea for a return to the natural and ancient food of our race, which is better understood when one knows that Miss Kingsford is a vegetarian. —— 'The Russian revolt' (Noble) gives a history of the development of the country, showing the effects of contact with western civilization, and closes with an appeal for a constitutional government for Russia. —— 'Wanderings of plants and animals' (Hehn and Stallybrass) is an attempt to trace the origin of well-known plants and animals by historic and philologic methods. The author holds that Europe owes much more to Asia than the mere botanist and mere zoölogist are willing to admit; that the flora of southern Europe has been revolutionized under the hand of man; and that the evergreen vegetation of Italy and Greece is not indigenous, but is mainly due to the sacred groves planted around the temples of oriental gods and goddesses. He has much to say of Indo-Europeans, or Aryans, at the time of their settling Europe, and holds that the builders of the lake villages in Switzerland were Aryans at a comparatively advanced period. In fact, the low condition of the Aryans on entering Europe, and their subsequent obligations to other Aryans in Asia, and, above all, to the Semitic races in Palestine, form, perhaps, the central idea of the book. —— 'Chemical conversion tables' (Battle and Dancey) are intended to meet a long-felt want on the part of agricultural analytical chemists for some relief from the time-consuming calculations necessary to convert the result of each separate determination into the customary per cent. They embrace only what is required in the analysis of commercial fertilizers and their derivative constituents. —— 'Notes on the chemistry of iron' (Troilius) gives a description of such chemical methods of analysis in iron and steel manufacture as have come under the author's personal observation. —— 'History of Japan' (Thorpe) is a history of the country from the earliest times, giving an account of the primitive religion, and of the different dynasties, and with an account of the recent progress of country. —— 'The principles of house-drain (Putnam) contains lectures delivered before Suffolk district medical society, the Boston s of architects, and the Massachusetts institu technology, on house-drainage, and the construction of wash-basins, closets, soil and pipes, with hints as to the size and general ar ments of piping. —— 'First lessons in ar photography' (Spaulding) gives the beginne few pages, an account of the general met taking a negative, and obtaining from it a print. The subject-matter is arranged in th of seven short lectures, which were origina livered before the senior class of a high That portion of the book relating to the and lens is treated very briefly, and the des of the process of development of the neg not stated as fully as might be desired. T eral criticism on the book is that there is n enough of it. —— 'De l'effet artistique e tographie' (Robinson et H. Colard) begins most books on photography leave off, t photography wholly from the artistic si doing so in a very thorough and satisfactor ner. We can commend the book to all wh to study the principles of art in photo and to those who wish to obtain really pictures, whether of landscapes, groups, traits.

GEOGRAPHICAL NOTES.

APROPOS of our comments on the facil navigation in Hudson Bay (*Science*, No. 350), we learn that the company's annual with a cargo valued at over a million, was r driven on the bar at the anchorage near Factory, the port of the region, and becam wreck.

The whaling fleet in Alaskan wate summer numbered forty sailing-vessels an steamers, with a total tonnage of 14,262 ton further disasters had occurred up to th advices, and the vessels embayed by ice nea Barrow had been safely extricated. One h and twenty-six whales had been taken.

The fishing fleet of the North Pacific has r to San Francisco. Fourteen trips were m twelve vessels, aggregating 2,550 tons. T taken in Alaskan waters numbered 922,0 from the Okhotsk Sea 452,000. The valu catch is about $150,000. This industry h successfully prosecuted since 1864.

The boundary between the territory of gentine Confederation and Brazil, formi

western limit of the province of Santa Catherina, has been for some time in doubt. Efforts hitherto made to settle it have been fruitless; and the disputed area between the Uruguay and Iguassu Rivers, a strip some seventy-five miles wide, has been regarded as neutral ground. In the little-known region known as the Missiones, formerly governed by the Jesuit missionaries, an old treaty between Spain and Portugal fixed upon two rivers, the Peperi and San Antonio, flowing respectively north to the Iguassu, and south into the Uruguay, as the boundary in question. The determination in modern times of the particular rivers, out of many existing, which were entitled to bear the above names, has been fraught with difficulty. The two governments have now agreed to a joint exploration of the neutral ground, in order that the matter may be permanently settled.

In the report of Governor Swineford of Alaska, recently made public, an interesting *résumé* of affairs in the territory is presented. Educational matters have made some progress, though a want of tact on the part of the agent of the bureau of education, notwithstanding his energy and ability, has aggravated difficulties which, in the nature of things, were serious enough already. The value of the south-eastern part of the territory is warmly maintained by the governor, who upholds essentially views expressed by many travellers, which it has been the fashion, on the part of ignorant or interested persons, to deride as 'rose-colored.' The success of mining and fishing enterprises, and the practicability of auxiliary agriculture, are insisted upon. Hardy vegetables do well, and cattle are sleek and in the best condition. The white population of this part of the territory amounts to 1,900, and that of the partly civilized natives to 7,000 more.

In this connection the New York *Times* very reasonably points out the usefulness of exploration in Alaska, as compared with arctic expeditions. The prospect of a survey of the very dubiously defined boundary will probably before long require systematic and extensive work in this direction. The indirect results of such investigation can hardly fail to be important.

ASTRONOMICAL NOTES.

Standards of stellar magnitudes. — The third report of the American committee on standards of stellar magnitudes states that the zones following the twenty-four selected equatorial stars have received a second careful revision with the Princeton 23-inch, which should make them include all stars down to about 16.0 mag., and that a revision will probably be made with the Washington 26-inch. Four of the charts have been distributed to all observatories having large telescopes, with requests for all visible additions which will furnish comparisons of the penetrating power of different kinds of telescopes. Certain selected standards in each zone, about 0.5 mag. apart, have been measured at the Harvard college observatory with photometer I, and the two brightest, if not too faint, with the meridian-photometer. A catalogue of these selected standards in the twenty-four zones, giving the positions and provisional magnitudes, is published, and also a table of twenty-one close circumpolars ranging in magnitude from 2.2 to 15.7.

Observing comparison stars. — Dr. Gill expresses the hope (*Astr. nachr.*, 2,688) that some of the numerous well-equipped European or American observatories will take up the systematic observation of stars that have been used in comet comparisons, faint stars whose occulations have been observed, zones of stars employed for scale or screw values, or stars that have been used for geodetic purposes. The editor, Dr. Krueger, heartily seconds the proposal, and announces that Dr. Hirsch, director of the Neuchâtel observatory, stands ready to determine the places of such stars at the request of computers of orbits. He hopes to announce later that other observatories have promised co-operation.

The new observatory of Bordeaux. — This observatory, founded in 1871, has just now (*Comptes rendus*, ci. 690) published its first volume of *Annales*, containing a minute description of the instruments (a meridian-circle of 0.19 m. aperture, two equatorials of 0.22 and 0.39 m., and three clocks), and also a determination of the longitude of the observatory. An important piece of work has been undertaken by the director, M. Rayet, in the re-observation of the 23,000 stars in Argelander's southern zones between — 15° and — 31° of declination.

Longitude of the Cordoba observatory. — In the *Astromische nachrichten*, 2,683, Dr. Gould publishes the finally adopted value of the longitude of the Cordoba meridian-circle, depending upon exchanges of longitude signals with Buenos Aires on the east, and Valparaiso on the west. Buenos Aires was determined by Capt. Green, U.S.N., via Lisbon and Rio de Janeiro, and Valparaiso by Commander Davis, U.S.N., via Washington and Panama, and the two results agree within $0^s.05$, a very satisfactory accordance. Dr. Gould adopts as the final definitive position of the Cordoba meridian-circle:—

$$\phi = -31^\circ\ 25'\ 15''.46$$
$$\lambda = 4^h\ 16^m\ 48^s.2,\ \text{W.}$$

The November meteors. — The regular November meteors or Leonids, moving in the orbit of Temple's comet (1866 I), are due between the 12th and 15th of the month, probably reaching a maximum display on the night of the 13th. The investigations of Prof. Kirkwood seem to indicate the existence of three separate clusters moving in this orbit, and there is a possibility of the earth intersecting a portion of one of the clusters the present year. Mr. Denning has pointed out that toward the end of the month circumstances appear to be extremely favorable for a recurrence of the Andromeda meteors (see *Science*, vi. 279).

Lick observatory. — In a letter to the *Sidereal messenger*, dated Oct. 20, Professor Holden expresses his thanks to the many astronomers and societies that have generously contributed to the library of the Washburn observatory, and he bespeaks a similar generosity for the Lick observatory, of which he is about to take charge. He requests that parcels intended for the observatory be addressed to the Library of the Lick observatory, San José, Santa Clara county, California, while such as are intended for himself personally be directed to Berkeley, California. Professor Holden says, "Real astronomical work at the Lick observatory will begin as soon as possible. Under the provisions of the trust, no salaries can be paid to observers until after the completion of the observatory; and this date depends upon the time at which the large telescope is finished by the firm of A. Clark & Sons. Every thing else is practically complete. I have hopes that some arrangement may be made by which the meridian circle and the 12-inch Clark refractor may soon be put to use." If the immediate inauguration of systematic observations at this observatory is contingent merely upon obtaining a fund sufficient to employ assistants during the two years, more or less, which must elapse before the permanent funds are available, we sincerely hope that the well-known liberality of California will come to Professor Holden's aid in advancing the interests of her magnificent gift to science.

NOTES AND NEWS.

The *Scientific American* of October 31 contains an article by John C. Goodridge, jun., entitled 'Can the temperature of the Atlantic states be changed?' It is neatly illustrated by two charts, and presents a dangerously entertaining, one-sided statement that will doubtless be pleasant reading to the uninformed. The error that vitiates the whole argument is the implication that the low mean temperature of our Atlantic states depends on their being next to the Labrador current that brings cold water down the coast, and shoves t Gulf stream out to sea. To remedy this defe it is proposed to dam up the Straits of Belle Is as if all the cold water came through that narr passage, and none reached us from the east co of Newfoundland! But even if we grant this, a build the dam, our winters would still be cold, their low temperature depends on the winds fr the great north-western interior, and not on t chill of the Atlantic waters.

— A circular has lately been issued by t University of Michigan, descriptive of a sche of undergraduate geological study, leading to degree of bachelor of science after four ye work. The subjects belonging strictly to geol are taught by Professors Winchell, Pettee, Cheever, and embrace general geology and pale tology, mineralogy and lithology, economic g ogy and metallurgy. Besides these, the c riculum includes a certain amount of mathemat chemistry, physics, French, German, and drawi and allows moderate excursions among elect studies. Field-work has no special time allot in the course, although it is noted that stude 'will incidentally acquire skill' in it. This, t the omission of surveying as a required stu seem to us as defects in the plan; the amount French and German also seems to fall short that needed to give an effective use of th essential languages; but, as a whole, the cou must give a good knowledge of theoretical a practical geology to the inquiring student.

— The Appalachian mountain club announ that a room of moderate size, suitable to the purp of the club, has been rented in the Ticknor m sion, on Park Street, Boston, possession to given about November 15. The club is not yet condition to employ a paid librarian or attend but it is expected that by unpaid attendance room can be open to all club members, with charge, during the afternoon hours of several d in the week, and perhaps, if a sufficient volunt force can be organized, every afternoon. It confidently believed that when the books, ma and photographs of the club are brought togeth and made for the first time accessible, the ro will prove a very attractive resort to membe and that the plan may be even so successful as warrant, within a few years, a removal to lar quarters in the same attractive building.

— A meeting of the local committee to arran for the coming session in Washington, of t American public health association, was held N 3. The committee on transportation report that a uniform reduction of rates had been secur for members on the railroads all over the count

meeting of the association the prizes by Mr. Henry Lomb of Rochester, for the ays on subjects of sanitary importance v. 80), will be awarded.

lliam Benjamin Carpenter, the eminent physiologist, died in London, November the effects of terrible burns caused by tting of a lamp while he was taking a th for rheumatism. Dr. Carpenter was Bristol in 1813.

long recent deaths we note the following : . A. Guy, at London, in his seventy-sixth an Claude Bouquet, mathematician, at his sixty-seventh year ; Dr. Max Sage- Amsterdam, August 2 ; Professor Hjal- mgren, mathematician, Stockholm ; Er- brueil, founder and publisher of the *es sciences naturelles*, at Montpellier, May fifty-sixth year ; Dr. J. Baeyer, president oyal Prussian geodetic institute, at Berlin, er 11, in his ninety-first year.

LONDON LETTER.

auguration of the first practical 'telpher ms to have passed into history without notice, though it is, in fact, the com- ent of a new means of transportation vil lprobably develop into an important f industrial, if not of social, life. It is ded to compete with railways, but to do the work of horses and carts, since by its ineral or agricultural produce of any kind conveyed over considerable distances in antities at a comparatively small cost, nd down steep inclines, without the need ructing a road. The term 'telpher' is a e, or at least convenient, abbreviation of compound word signifying 'carrying d a telpher line may be briefly described erial light railway, driven electrically. em is the invention of the late Prof. Fleem- kin, F. R. S., and it has been severely r some months on a large experimental rof. Jenkin did not live to see the first line completed, and the final arrange- ere worked out by Prof. Perry, the to the Telpherage company. The line er consideration is constructed at Glynde, ssex estate of Lord Hampden, late speaker use of commons, and conveys clay from to a railway siding. It was opened on 9. It consists of steel bars, ¾ of an inch in and 66 feet long, supported 18 feet above n T-shaped posts about one chain apart. s of way, an up and a down line (one bar sufficing for each), are supported 8 feet apart on the cross-head of the T, the general appearance of the whole being not unlike gigantic telegraph posts and wires. The carriers, or 'skips' as they are technically termed, are iron trough-shaped buckets, each holding about 2 cwt., and suspended from the line by a light iron frame, at the upper end of which is a pair of grooved wheels, running along the line of rods. A train is made up of ten of these, the electric motor being in the centre. An automatic block system is provided, so that as many as twenty trains can be run on the line at once without possibility of collision. Moreover, an electric governor has been devised, so that the trains run at the same speed both on rising and falling gradients, even when the incline is 1 in 8. The initial source of power is a Ruston & Proctor engine, controlled by a Williams electric governor; this drives a Crompton 6 'unit' shunt-wound dynamo. The maximum difference of potential is 190 volts, and the current for one train is 8 ampères. The Reckenzann motors run in parallel arc, and the resistance of each is large compared with that of the rods used to support the train and convey the current. The uniform speed is about four miles per hour, and it is claimed that material can be conveyed at a cost varying from 4 to 15 cents per ton per mile. A friend of the present writer has proposed to the Telpherage company to lay down a line in Trinidad, to bring material to the coast, the conveyance of which on muleback at present costs nearly $2 per ton.

The death of Dr. Thomas Davidson will be severely felt at Brighton, where he had resided for some years past, as he was accustomed to devote a considerable amount of time and trouble to the arrangement of the geological and zoölogical collections in the town museum.

The beginning of the academical year at Oxford has been signalized by the opening of the new physiological laboratories, at the back of the university museum. The anti-vivisectionist party, in convocation, headed by some prominent resident members of the university, have made two determined attempts to prevent Professor Burdon Sanderson from teaching physiology as it should be taught; but, fortunately for science, their efforts have been unsuccessful, and another great step has been made towards improving the medical school of the university.

On Nov. 9 the International inventions exhibition will be closed. The attendance up to the present time has been nearly 3,750,000 persons, and at present cheap excursion trains are being run from all parts of the British islands. The nightly simultaneous illumination of 10,000 glow electric lamps, and the marvellous chromatic dis-

plays with the electric light and the fountains, under Col. Sir Francis Bolton, still attract large crowds.

At a recent 'Gilchrist trust' lecture in Greenock, by Mr. William Lant Carpenter on the telephone, transmitters were placed on the lecture-table, and a party of ladies in the office of the *Glasgow herald*, twenty-five miles away, heard nearly the whole of the lecture.

In a district of London known as the Borough, and inhabited by a similar population to that in the Bowery, New York, a large theatre has recently been taken, mainly at the cost of the Duke of Westminster and Mr. Samuel Morley, and has been converted into a temperance music hall. For three or four years, on one night a week, for seven or eight months in the year, popular lectures on science are delivered, in which many very eminent men take an interest. Sir John Lubbock will lecture there on Nov. 3, upon ants. Temperance meetings, ballad concerts, and 'variety entertainments' occupy other nights in the week, and the managers are constantly receiving remarkable testimony to the good done by 'the Vic,' or Royal Victoria coffee-hall. W.

London, Oct. 31.

ST. PETERSBURG LETTER.

The meteorological conditions of the last summer have attracted general attention in Russia. It is but too common to hear of the coldest or hottest season remembered by the oldest inhabitant; but the heat of the end of June, and of the whole of July, in the greater part of European Russia, was truly exceptional. In St. Petersburg the mean temperature of July was 21°.2 C.,—the highest since the observations began (1743), with the exception of July, 1757. In Moscow the mean temperature of July was 22°.5 C. — the highest in the seventy-five years' observations, except July, 1826, when it was 0°.1 higher. But as the mean of the present July is from observations outside the city, while in 1826 the observations were made in the city, it is probable this July was hotter. The heat was especially remarkable for its unabated continuance. It seems that long-continued anticyclones existed in the north and north-east of Russia, and thus warm and dry south and south-east winds were prevailing. A very great scarcity of water followed, especially in the south, where already the spring months had been dry. Lakes, ponds, and wells dried up, and some villages were obliged to sell all their cattle for want of water; and that for drinking purposes had to be brought from many miles away. In the north and centre of Russia many swamps dried up entirely, and, in July and August, forest and fires occurred in many parts of the country. large rivers were exceedingly low, and navig seriously impeded; so that on the Volga was low water as far down as Stavropol, Simbirsk, while formerly it was not observed down than the mouth of the Kama.

From the beginning of August in some pa the south, and later on in other parts of R heavy and protracted rains followed, seri damaging the harvest, and interrupting the ing of the railroad from Ekaterinburg to Tju in Siberia.

The first general meeting of the geograp society this season was held on the 14th of ber, and the following news was communi by the secretary: two additional govern grants had been received by the society; thousand rubles for the classification of th lection and publication of the travels of th ceased zoölogist, Sjevertzof, and two tho rubles for the collection of the music of the of the people. The first expedition, to st 1886, will consist of the musician, Dutsch, a secretary of the ethnographical section, an visit the northern part of Russia, where the old lore has been better preserved, owing to the ab of railroads and great cities. A thousand have been bequeathed by the deceased me Prince N. M. Galitzin, for geographical explor The proposed expedition to the glaciers Chang-Tengri, in the Thian-Shan, for whic society had granted an allowance, was post till 1886.

Besides the Iswestia (transactions), the foll volumes of the memoirs have been issued, in preparation: vol. xiv., on general geog containing Dr. Sperck's 'Russia of the far This is a general description of the Amur co including topography, climate, fauna, flor nography, etc. The most interesting part i on the colonization. The author has long r in the country. Vol. xv., part i., will also s issued. It will contain the results of the Si levelling. This is certainly the most important ling yet made, from its extent as well as fr importance of the results arrived at, bearing geography of Asia, the climate, etc. Part the same volume is issued. It contains A. kof's paper, 'On a covering of snow, its inf on climate and weather.' Vol. xvi. is in pri consists of a description of Lapland by Dr. arow, formerly Russian consul at Hammerfe fruit of extensive travels in the country.

The branches of the geographical societ generally late with their reports, so that they but just sent in those for 1884. From th

branch (Irkutsk) it is learned that Sanni-elled on the upper Man River, following undred versts, to its confluence with the He met with numerous and interesting rocks, all on hard, nearly vertical surfaces. e visited the Minussinsk district, and l many tumuli, statues, and peculiarly stones, probably having a signification in al ceremonies of the former inhabitants. casian branch (Tiflis) reports generally on raphical work in the Caucasus. As before, casian military topographical section has od work, especially east of the Caspian. graphic determination of longitude be-Batum and Nikolaiew has been made. Stebnitzky has prepared a large work on raphy of the Caucasus. The hydrograph-k on the east coast of the Black Sea, under Zarudny, continues. Four new meteor-stations have begun work, and it is hoped have two stations on the road across the n chain, and one at Kars. These reports tain a large amount of information in re-the other geological and ethnological ex-is going on. O. E.

ersburg, Oct. 15.

LETTERS TO THE EDITOR.

ondents are requested to be as brief as possible. The ame is in all cases required as proof of good faith.

Flood Rock explosion.

rticles upon the Flood Rock explosion con-n your issue of October 16, to which my has just been called, though evidently the es of men who are more familiar with the rk of the study than with the varied and ted requirements of engineering practice, an answer through your columns, in order fair-minded portion of your readers may nisled into erroneous judgments through the nd unfriendly remarks concerning the delay the mine that have been placed before them. ory of the Flood Rock explosion may be told y few words. For ten years a great work ering, costing a large amount of money, had ing on, the successful accomplishment of epended upon the successful explosion, by l action, of 290,000 pounds of high explo-he whole work required the most careful d forethought, to avoid accident to life or l to eliminate, as far as possible, the chances ge to any part of the system, upon whose er, at the critical moment, the success of rtaking depended.

essential that, as soon as the mine should , it should be fired, for at any moment there sibility of accident to the apparatus, which lay, if not ruin, the work of years; but at ie precisely we should be ready for the ex-ould not be certainly predicted, though from n which the work was progressing, we hoped dy to fire at high water, 11 A.M., on Satur-day, October 10. Work on the mine had been going on night and day under the personal direction of Lieutenant Derby, who spared himself no inconvenience and avoided no danger connected with it, in order to get the thing through in time; and yet, as it happened, the preparations could not be quite completed until a few minutes after 11 o'clock on the day appointed, when the mine was fired. I hardly need say that this delay was unavoidable.

General Abbot, who had been requested by General Newton to take charge of the photographic and the seismoscopic arrangements for the explosion, had by personal application to the superintendent of the Western union telegraph company, secured the use of a wire for a short time, from the firing point at Astoria to Patchogue in one direction, and to West Point in the other; and when the representative of the geological survey applied to him for information in regard to the explosion he offered to send chronometer ticks to the Western union office in New York, so that they might be transmitted to the observers who were not under his (Gen. Abbot's) orders. No advantage was, however, taken of this offer, though the Western union company would doubtless have been as willing to grant the use of their wires to these gentlemen as to General Abbot.

One of our engineer points of observation, that at Willet's Point on Long Island Sound, was not connected electrically with the firing point; the nearest telegraph station being three miles distant, at Whitestone. Yet the young officers who were detailed to watch the seismoscope there, watched until they got their observations, and would have watched for an hour if necessary, or until notified to stop. Observations, it is stated, were also successfully made at Columbia college, Yonkers, Princeton, and Cambridge, though none of the observers at these places were in electric connection with the firing point.

The same degree of intelligence which secured successful results in these instances would doubtless have prevented Professor Paul from losing his observations at Staten Island, and would have saved him the discredit of having written a very ill-tempered letter; and an intelligent study on his part, of the results of the explosion at Hallet's Point in 1876, would have prevented him from mistaking the slight disturbance which he observed, for that which would necessarily be produced by the explosion of nearly 150 tons of high explosives.

If, then, there was, as has been charged, any blundering or want of intelligent co-operation in this matter, it is evident that it was on the part of those who failed to take the necessary precautions to insure the success of their observations, and not on the part of the corps of engineers of the army, whose long and honorable service has been uniformly marked by an intelligent and faithful performance of its duties, and by freedom from mean and degrading jealousies.

WALTER MCFARLAND,
Lieutenant-Colonel of Engineers.

New York, Oct. 28.

I fully acknowledge that the time observations upon the explosive waves from Flood Rock were a matter of secondary importance, mostly of scientific interest, and, even in the 'quiet of the study,' think I can appreciate, perhaps not fully, but in a high degree, the complicated difficulties in the way of

successfully bringing about the explosion, so graphically described in Colonel McFarland's letter.

From the stand-point of an outside would-be observer, the story of the Flood Rock explosion may be told as follows. The idea of determining the velocity of the vibrations through the ground was suggested at a late date, and the preparations were necessarily hurried and incomplete. No official information could be obtained, fixing even approximately the date of the explosion, and we were obliged to depend upon the newspapers for that information. Near the end of the week preceding its occurrence, the papers announced that the time was set for Wednesday, October 7, at 9 A.M. We hurriedly collected the apparatus prepared to date, boxed it, and shipped it to New York on Monday the 5th, and were to follow it that night, when the evening papers announced a postponement probably till Saturday the 10th. Nearly all the astronomical observatories within 200 miles of New York had been invited to co-operate (see *Science*, vi. 327), and had been asked to watch the New York papers, and been promised a telegram several hours before the event, fixing, if possible, the nearest minute at which it would occur.

The announcement and warning by General Newton on the afternoon of Thursday the 8th, together with a letter at the same time to the representative of the geological survey, were the first information we had of the time set for the explosion.

I would say that General Abbot cordially cooperated with us, and that his offer to send his time-signals to the Western union office (after the explosion) was duly appreciated. We did not take advantage of it, however, as it would have been very troublesome to distribute signals to fourteen observatories or institutions scattered in all directions over an area of 200 miles radius, and it was entirely unnecessary, as every one of them had the means of determining standard time for itself, or was in daily receipt of standard-time signals at noon. With the delay in the time of firing, of which we do complain, we understand that General Abbot had nothing to do.

It should be distinctly noted that the engineer observers within sound of the telegraphic ticks from the chronometer at Astoria, and waiting for the preliminary automatic signal from the firing-key, were in a vastly more favorable position in case of delay; and if this had been anticipated, and there had been time and opportunity to distribute the chronometer ticks and firing-signal to all the outside stations, of course it would have been done.

Regarding the observations cited by Colonel McFarland as having been successfully made at Columbia college, Yonkers, Princeton, and Cambridge, I would say that, at the first two, it was due to their proximity, while, in view of Professor Young's description of the Princeton observations (*Science*, vi. 335), it seems somewhat of a strain upon the meaning of language,— unless used in some approximate, engineering sense,— to call them a success; and at present the writer considers it somewhat doubtful if the Cambridge observations refer to the explosive wave. The statement that the two officers at Willet's Point would have watched an hour, if necessary, only goes to show how much better posted the engineer observers were as to a possible delay in the firing.

As to my own observations at Staten Island, their failure is of itself of little importance, but it is to me a source of wonder and sincere admiration to see how much more an engineer officer can know about them than the observer himself. They will be described in due time with the other reports. At present I can only say that under the same circumstances, if endowed with only the same 'degree of intelligence' I then possessed (even after a study of the Hallet's Point explosion of 1876), I should probably do just the same again; but, with the rapid growth since Oct. 10 of my knowledge of engineering science, I can hardly state now how long I would *not* wait for the occurrence of a definitely predicted engineering phenomenon.

Suffice it now to say that eight out of the seventeen stations were successful in observing either the first arrival or the pretty certain non-arrival of the vibrations. The others were all thrown off by the delay, combined, in four cases, with observation of earth-tremors occurring at several places during the first ten minutes after eleven. It would almost seem as if the earth itself were, about that time, growing uneasy at the delay in the oncoming of the dread event.

H. M. Paul.

Washington, Nov. 9.

The arms of the octopus, or devil fish.

Prof. T. Jeffrey Parker (*Nature*, October 15, p. 586) refers to an octopus of the New Zealand fauna, with arms five feet five inches long, as the longest seen by him, and as exceeding what Mr. Henry Lee calls the longest-armed octopus known, namely, that from Vancouver Island, which had arms five feet long.

In 1874 I speared an octopus in the harbor of Iliuliuk, Unalashka, which was afterward hung, by a cord tied around the body immediately behind the arms, to one of the stern davits of the coast survey vessel under my command. As soon as the animal died and the muscles relaxed, I noticed that the tips of the longer tentacles just touched the water. On measuring the distance with a cord, I found it to be sixteen feet, giving the creature a spread from tip to tip of the longest pair of arms, of not less than thirty-two feet. The arms toward the tips were all exceedingly slender, but rather stout toward the body, which was somewhat over a foot long. The largest suckers were two and a half inches in diameter; the whole creature nearly filled a large washtub. Parts of this specimen are now in the U. S. national museum. Having heard octopi were eatable, and the flesh looking white and clean, we boiled some sections of the arms in salt and water, but found them so tough and elastic that our teeth could not make the slightest impression on them.

Wm. H. Dall.

Washington, Nov. 8.

The care of pamphlets.

In printing my letter on p. 408 of your issue of Nov. 6, you printed the Dewey classification numbers with a comma, thus obscuring their character as decimals. According to the custom of Mr. Dewey, you might have placed a comma or period after the third figure, but unless you did that you should have printed them without punctuation marks; 526, for instance, is a primary division, of which 52641 is a subdivision.

P. Pickman Mann.

SCIENCE.—SUPPLEMENT.

FRIDAY, NOVEMBER 13, 1885.

THE RESULTS OF SHAD PROPAGATION ON THE ATLANTIC COAST.

AT a recent meeting of the Biological society of Washington, Col. Marshall McDonald read a paper upon the necessity of artificial propagation, in relation to the maintenance of the shad fisheries. He argued that the shad fisheries depend upon artificial production for their maintenance. This theory was illustrated by a comparison of statistics for 1880 and 1885, and a consideration of the attendant conditions. The figures for 1880 were taken from the census reports; those for 1885 from a recent reconnoissance by experts, usually the same persons who made the census reports. He brought together the statistics of all the rivers of the Atlantic slope. The catch in each river fluctuates under local conditions. It is not true that shad, spawned in certain rivers, necessarily return to the same rivers. They remain, it is true, in the geographical area in which they were spawned, but may seek any fresh water within that area. It is only by taking the statistics of the rivers of the entire area that it could be determined whether there had been an actual increase or decrease. Table I. giving "Comparative statistics of the shad fisheries on, or in the vicinity of, their spawning grounds, being captured for the most part before they had spawned, it will be seen that we are dependent for natural reproduction upon the small number of shad that escape the pound nets and elude the energetic pursuit of the river fishermen.

TABLE I.

COMPARATIVE STATISTICS OF THE SHAD FISHERIES OF THE ATLANTIC COAST RIVERS FROM CAPE COD, MASS., TO CAPE HENRY, VA., FOR 1880 AND 1885.

	Number of shad taken in 1880.	Number of shad taken in 1885.	Per cent of increase or decrease.	Remarks.
Connecticut River and tributaries	268,608	215,000	25% Decrease.	The aggregate increased catch of shad in 1885 over 1880 amounted to—
Hudson River	781,628	1,174,028	33% Increase.	
Delaware River and Bay	735,300	1,148,496	36% Increase.	In quantity.....1,050,000 lbs.
Chesapeake Bay and its tributaries	2,084,600	1,632,600	21% Decrease.	In value.....$73,530.
Aggregate catch	3,870,136	4,170,124	7.8% Increase.	

TABLE II.

COMPARATIVE STATISTICS OF THE SHAD FISHERIES OF CHESAPEAKE BAY AND ITS TRIBUTARIES FOR 1880 AND 1885.

	Number of shad taken in 1880.	Number of shad taken in 1885.		Total number of shad taken in 1885.	Per cent of increase or decrease.	Remarks.
		In salt water	In fresh water			
By pound net fisheries in Chesapeake Bay outside of the mouths of the rivers	593,243	713,448	.....	713,448	20% Increase.	67% of all shad taken in the Chesapeake and its tributaries in 1885 were taken in salt or brackish water before reaching spawning grounds.
Susquehannah River and minor tributaries at the head of Chesapeake Bay	614,000	50,000	162,161	212,161	65% Decrease.	
Potomac River	582,800	60,000	97,697	157,697	74% Decrease.	The 33% taken by the river fisheries
Rappahannock River	134,000	220,000	30,000	250,000	86% Increase.	
York River (all salt water) catch, included in the pound net fisheries of the bay	.....	.....	.....	.....	.....	
James River	106,000	45,000	200,000	245,000	131% Increase.	
Minor tributaries of the Chesapeake on eastern shore of Maryland and Virginia	54,500	27,250	27,250	54,500	.....	
Aggregate catch	2,084,543	1,115,698	517,108	1,632,806	21% Decrease.	

While the commercial value of the increase was not large compared with the whole, that sum was ten times as great as the yearly sum spent by the fish commission upon the work of propagation.

In order to arrive at a measure of the increase or decrease of the shad fisheries of the Atlantic coast rivers, it is necessary to compare the aggregate catch in the principal rivers. Conclusions

based upon the fluctuations of catch in a single river are necessarily fallacious, since such fluctuations are due to local causes. So far as the shad is concerned, all the rivers draining into the Atlantic between Cape Cod and the capes of the Chesapeake, and the submerged continental borders lying between the coast line and the Gulf Stream, constitute a single zoölogical province, within the limits of which the migrations of the shad are confined.

In February and March, when their migrations into continental waters begin, the direction of their movements is largely determined by temperature conditions existing in the area in which they are. The principal migration may be into the Chesapeake, or it may be up the coast into the Delaware, the Hudson, and the Connecticut; but in either case the aggregate catch will furnish a just measure of increase or decrease. A comparison of the statistics of the fisheries for 1880 and 1885 (see table I.) shows a gain of nearly eight per cent in the aggregate catch. The significance of this, as showing the value and necessity of artificial propagation, will be better appreciated by considering the adverse conditions under which it has been accomplished:—

1. Access to suitable spawning grounds in fresh water is a physiological necessity.

2. Access in sufficient numbers to compensate by natural reproduction, waste by casualty or capture, is necessary to prevent the eventual destruction of our shad fisheries if we rely upon natural reproduction solely.

3. Existing adverse conditions limit natural reproduction, so that we cannot depend upon it to keep up supply.

(*a*) Dams in our rivers have curtailed the spawning areas to less than half of what they formerly were.

(*b*) The spawning grounds still accessible have been destroyed by the pollution of the waters, which are thus rendered unfit to sustain the delicate embryo shad.

(*c*) The change in the location of the fishing grounds, and the increasing proportion of shad taken year by year outside of the mouths of the rivers, or in the rivers before they have reached spawning grounds, has so reduced natural reproduction as to render it an insignificant factor in keeping up supply.

Under such conditions, the spawning area being limited, and the shad excluded from fresh water, without artificial propagation, the shad must soon be exterminated, or there must at least be such reduction as to render the fisheries unprofitable. Such a crisis was fast approaching in 1879, when the fish commission began the work of shad propagation. The work of artificial propagation has not only held the balance even, but resulted in a slight increase.

Colonel McDonald deprecated the methods employed in shad fishing, especially the use of pound nets. In the Connecticut River, where pound nets are used, the greater part of the catch is taken in salt water. In the Hudson, since the laws of New York do not permit fishing with pound nets, the river is not obstructed to the same extent as the Connecticut. In the Delaware, where an increase is shown, there are no pound nets. In the Chesapeake and its tributaries, with a decrease of 21 per cent, 718,000 of the shad caught this year, or more than one-half of the whole catch, were caught in the salt water of the bay. The pound nets begin at the capes, and extend to the mouth of the Potomac. Prior to 1871 the shad were taken entirely in fresh water, but now over one-half are caught in salt water. In the Potomac River nearly one-half of the catch is made in water where the fish cannot spawn. In the Rappahannock one-half the catch is in brackish water. In the York River the catch is practically below Gloucester Point. In the James River there are no pound nets, and in that river is an increase in the catch. While the fisheries in the Chesapeake Bay and its tributaries, as a whole, have fallen off 21 per cent, the decrease in the catch in certain rivers is much greater. The catch in the Susquehanna in 1880 was 614,000, against 212,000 in 1885; and in the Potomac, 552,857 in 1880, against 157,697 in 1885. The reason of this is obvious. In 1871 there were no pound nets in Chesapeake Bay, and no shad were taken until they entered fresh water. Gilling was not prosecuted so low down the river as now. In 1880 there were in Chesapeake Bay 180 pound nets set in the track followed by the shad along the western shore, and through these the shad had to run a gauntlet up to the mouths of the rivers. Now there are 1,000 pound nets, occupying the western shores of the bay, and excluding the fish from the fresh water. The effect of the salt-water fishery is to diminish natural reproduction, and to invoke artificial propagation as a necessary aid to the fisheries. If all shad were excluded from our rivers for three or four years, without artificial propagation, the species would be exterminated. Taking all the facts into consideration, and the inadequacy of natural reproduction to supply the annual loss, we must credit artificial reproduction not only with having maintained the fisheries where they were, but with an increase which repays ten times the cost of the work of shad propagation, as carried on by the U. S. fish commission and those of the several states.

INFANT PSYCHOLOGY.

THE modern psychologist must be a very busy man. We may suppose him to be a college professor, introducing his students into the principles of his science. Besides this, he is the director of a psychophysical laboratory, where he subjects himself and others to tortuous and tedious experiments, almost deserving the name of vivisection. Moreover, he must be intimate with the asylums for the insane and the idiotic, in order to study the mind in its morbid conditions; he must be at home in institutes for the blind and for deaf-mutes, in order to appreciate the *rôle* played by each sense in the sensual and intellectual life; he must talk to the inmates of prisons and poor-houses in order to understand the condition of those in whom the instinct of morality and the power of the will are at a low ebb; he must be active in psychic research and be ready to investigate the claims to unusual mental faculties; and now for what remains of his time, he is called into the nursery.

'Infant psychology' (by which name we must now know this field of study) has for its aim, the tracing of the mental development,—the psychical evolution,—of the infant from birth upward. The literature of the science is as yet small; every single contribution, however, has been made by able hands; and the work of M. Perez[1] is a good type of this new tendency in modern psychology. In his former educational works as well as in his ingenious study of his 'two cats' (Mes deux chats), M. Perez has proved himself possessed of an unusual psychological acumen. We probably owe the appearance of this book in an English dress to Mr. James Sully, who prefaces it with an appropriate introduction; great credit is due to the translator (Alice M. Christie) for her careful and easy rendition.

It would be impossible here to do more than indicate the general lines of interest pursued in the book, and sample its method and wealth of facts.

We may trace as many as five distinct interests which such study furthers:—

1. It interests the pyschologist, as an important chapter in the study of mind, its psychogenesis.

2. It interests the anthropologist, to whom the remarkable analogy between the mental world of the child and that of primitive savages, is rich in suggestiveness. Impulsiveness and irascibility, to give one of a host of examples, are seen almost in the same aspect in savages and children. 3. It interests the alienist who finds, in the degeneration of mental tissue as shown in his insane patients, the same mental peculiarities, but occurring in a reverse order, as in the process of brain building in the child. The earliest memories are the last to fade away: the old man becomes childish. 4. It interests the student of comparative psychology, who notes the strong resemblances between the reasonings of the child and those of the higher animals. They fall into the same kind of errors and exhibit the same kind of peculiar tendencies; witness how often a child is called a 'monkey,' or a 'pussy.' 5. Lastly it interests the educator. The human child spends its first years in a condition of helplessness such as is seen in no other animal. It needs more watchfulness, more care, more education. To give this education, in a rational way, requires the study of the infant's mind, "for the cardinal principle of modern educational theory is, that systematic training should watch the spontaneous movement of the child's mind and adapt its processes to these" (Sully).—All of these will find that none of their points of view has been neglected in this book.

The scope of the work is wide: it covers really everything that can be called psychic in the first three years of life. Indeed the first chapter treats of the 'Faculties of the infant before birth.' From its first cry on entering this world (which Schopenhauer takes as a pessimistic omen), his first movements, sensations, emotions, expression of will power, all are recorded and from them his mental status deduced. Systematic experiments are arranged and spontaneous movements and expressions noticed as well. The last chapters are devoted to the reasoning powers of children, their language, their logic, their æsthetics, their ethics, and, a very interesting point, their dramatic instinct.

Take the sense of taste for example. It is in the sphere of this sense that the child's first pleasure is felt, a few hours after birth, in the appeasing of hunger. At an early period disgust through taste is possible. A child 2½ months old refused its bottle with determination and a face of disgust, because it was not sweetened with sugar. Illusions of taste appear early. The taste of children changes easily, which is a reason for not forcing them to eat things against their inclination. Its most vivid sentiments are for a long time connected with this sense. "Their first affections are those of an epicure; their first feelings of gratitude are awakened by the stomach; they test their first tactile experiences as much as possible by the sense of taste." Everything goes to the mouth. "*Pretty to look at*, and *good to eat*, are synonymous terms to babies." We can see how largely their earliest mental horizon is dominated by the feeling of hunger and the sense of taste.

The emotional life of the child begins early. Fear is one of its first emotions. Darwin l

[1] *The first three years of childhood.* By BERNARD PEREZ. Translated by Alice M. Christie, with an introduction by James Sully. London, *Sonnenschein*, 1885. 294 p.

noticed signs of fear at an unexpected noise or strange face in the first weeks. Between the 3d and the 10th months, fright is caused more often by auditory than by visual impressions. A child of 3½ months showed no sign of fear at a conflagration, though surrounded by flames, until the noise of the fire engine was heard, and then he trembled and cried. Thunder terrifies rather than lightning. This is referred to as hereditary and the result of anterior experiences, which have "rather predisposed the race to listen for dangers which are near at hand, than to be on the lookout for distant ones." The reverse is true of most animals.

Finally as an example of the logical powers of infants, that of generalization will serve. Dogs generalize; they bark at all beggars; yet they distinguish one beggar from another on nearer approach. A child had a tin box into which he used to delight to stuff things; he soon found that other of his toys had the power of holding things; then he tried to find an opening in everything, into a glass stopper because it was transparent; in short, he had acquired a general idea of an opening. Another child had a canary named 'Koko'; when he saw chickens in the yard or ducks in the pond, they were 'Koko' too. While these young children generalize before the acquisition of language, they do not compare. A child was shown a print and stretched out her hands for it; then a colored print was shown; her joy was beyond bounds. In a second experiment both were shown at once; she took them for one picture and threw herself towards both; her attention was not directed to the brighter one. These illustrations are doubtless sufficient to indicate the character of the volume.

The record of one or two infants is naturally unsatisfactory; individual peculiarities are certain to enter. What is wanted is a collation and average of many observations. For England, Darwin and Pollock, for France, Taine and Perez, for Germany, Tiedemann, for Austria, Preyer, for Italy, Ferri, have contributed to this study. May we not soon expect to hear as to the psychology of the American baby? J. Jastrow.

LEGAL OHM STANDARDS.

After the decision of the Paris electrical congress of 1884, that the standard resistance, or legal ohm, should be the resistance of a column of mercury of one square millimetre cross-section, and 106 cms. in length, at zero centigrade, it became necessary to construct standards that should represent this resistance. In France this task was intrusted by the minister of posts and telegraphs to M. J. R. Benoît; and in England Mr. R. T. Glazebrook, at the request of the electrical standards committee of the British association, undertook the same work.

M. Benoît attacked the question *ab initio*. From a large number of glass tubes, of about 120 cms. length, and 1 mm. diameter of bore, the four that had the most uniform bores were selected. These tubes were laboriously calibrated to determine the cross-section at every point, and each was then cut off so that the resistance of the column of mercury filling the tube should be as nearly as possible the same as that of the column defined as the standard. The points where the tubes were cut off were determined from the calibration. The resistance of each tube was then calculated from its dimensions, with the following results:—

Tube 1 = 0.999999 legal ohms.
2 = 1.000004 ,, ,,
3 = 0.999979 ,, ,,
4 = 0.999994 ,, ,,

The tubes were then cleaned by passing through them successively strong nitric acid, ammonia, and distilled water; then filled with pure mercury, and their resistances compared by balancing them against each other in a Wheatstone's bridge. This comparison showed, that, if the mean of the calculated resistances be the mean of the true resistances, the resistances of the several tubes are as follows:—

Tube 1 = 1.000018 legal ohms.
2 = 0.999996 ,, ,,
3 = 0.999959 ,, ,,
4 = 1.000003 ,, ,,

Accepting these as the true resistances, M. Benoît made a number of secondary standards, of glass tubes doubled upon themselves and bent into compact forms, and with cups at each end for making contact. The resistances of these tubes, when cleaned and filled to certain marks on the cups with pure mercury, were determined by comparison with the primary standards mentioned above.

Mr. Glazebrook considered it unnecessary, for the construction of the required standards, to go through the laborious process adopted by M. Benoît, for the specific resistance of mercury had been determined in terms of the British association standards, in several elaborate investigations by Lord Rayleigh, Mascart, Strecker, and others, and so based his standards on the value of the resistance of mercury adopted by the British association committee; viz., a column of mercury at zero centigrade, one metre long, and one square mm. cross-section, has a resistance of .9540 B. A. units.

Mr. Glazebrook has made a careful comparison of his legal ohm standards with those made by Benoît, and finds that there is a difference of .0005 ohms between them, the Benoît standards being less by that amount.

Two of these Benoît standards gave different results at different times. For instance, one whose resistance had been designated as 1.00045 legal ohms by Benoît, showed, when first filled, the same resistance in terms of the Cambridge standards; the next day its resistance was found to be 1.00071, and, on flowing the mercury back and forth through it, it rose to 1.00080. The tube was examined, but no trace of an air bubble was seen. It was then cleaned and filled again, and afterwards gave consistent results, the mean being .99990 legal ohms, though the same precautions were taken in the first filling as in the last. This result indicates the uncertainty of mercury standards, and the extreme care that is required to obtain consistent results. Every mercury standard should be made of such a form that the tube can not only be washed, but wiped out by some mechanical means. It is important to notice that the rate at which the resistance of mercury varies with the temperature has been examined lately by Mr. Glazebrook, and he finds that the rate of change diminishes rapidly as we approach 0°; the average change between 0° and 5° being .000834, while between 0° and 15° it is .000879.

CHOLERA PROSPECTS FOR ENGLAND.

IN regard to the prospect of the cholera reaching England this season, the *Lancet* of Oct. 24 says: We have now reached a period when we may fairly form a judgment as to the more immediate cholera prospects for England. Although cholera in Europe usually follows certain definite rules as to climate and season, yet it deviates from these sufficiently often to impart an element of uncertainty to any opinion concerning its movements. But notwithstanding this, the chances of any extension of the present epidemic to this country are now so remote that we may fairly conclude that we have for a third year escaped from the danger with which we have been threatened. It is true that in 1884 our greatest danger did not arrive until Paris had become infected, and that this did not take place until we were well into the first week of November; but, on the other hand, the extent and the area of diffusion of cholera in France was last year far greater than it has been this year, and cholera deaths occurred in 1884, both at Toulon and Marseilles, until about the end of November. This year, on the contrary, France has practically been free from cholera for some time, and the main risk we have to contend with lies in our shipping relations with Spain and Sicily, and these are limited both in amount and in the number of home ports concerned. So, also, we have had evidence that the vigilance and activity which have been exercised by our port authorities with regard to any such importations have been successful, even when, in a few occasional instances, there was reason to believe that isolated cases of the disease had found their way to our shores. And, further, the danger from places in the south of Europe, which are still infected, is every week becoming less by reason of a general subsidence of the epidemic. On the whole, therefore, we may with a considerable degree of confidence conclude that we have another season before us during which we may, unhindered by any element of panic, go on maturing our preparations to withstand such danger of cholera importation as may recur next year; and we have the satisfaction of knowing that the preparations needed are precisely those which will tend to diminish mortality from other causes than cholera, and that the needed expenditure will in the end tend to our prosperity.

ARTIFICIAL PROPAGATION AND CULTIVATION OF OYSTERS IN FLOATS.[1]

WITHOUT expressing any opinion as to the value of the process of 'fattening' oysters by placing them for a few days in cars floating in fresh water, I wish to point out that there is no similarity between this process and the process of propagation which is here described.

My attention was first called to the value of floating cars in oyster culture by Mr. William Armstrong of Hampton, Virginia, who informed me in 1884 that 'seed' oysters, which he had placed in floating cars in the mouth of Hampton Creek, grew more rapidly, and were of a better shape and more marketable, than those which grew from seed planted on the bottom in the usual way.

One of the results of my study in 1879, of the development of the oyster, was the discovery that there is a period of several hours, immediately after the embryo acquires its locomotor cilia, when it swims at the surface, and this is the period when it is swept into contact with collectors. As soon as the shell appears, the larva is dragged down by its weight, and either settles to the bottom and dies, or swims for a time near the bottom. The tendency to swim at the surface is an adaptation for securing wide distribution by means of the winds and currents which sweep the young oysters against solid bodies which may serve for attachment; and the greatest danger to which the oyster is exposed, at any part of its life, is that it may not, at the swimming stage, find a clean, hard surface for attachment.

[1] From *Johns Hopkins university circulars*, October.

As it is microscopic and only about half as thick as a sheet of thin paper, it may be smothered by a deposit of sediment or mud so light as to be invisible; and most of the failures to get a good 'set of spat' are due to the formation of a coat of sediment upon the collectors before the young oysters come into contact with them.

It occurred to me this summer that this danger could be entirely avoided by the use of floating collectors; for little sediment can fall on a body which is close to the surface of the water, and most of this will be swept away by currents, which will, at the same time, sweep the swimming embryos down into the collector, and thus insure an early, abundant, and successful 'set.'

I accordingly constructed a floating car, made so as to permit the free circulation of the water. This was filled with clean oyster-shells, and moored in the channel in front of the laboratory at Beaufort, N. C., on July 4. As all the oysters in the vicinity were in very shallow water, they were nearly through spawning, and the conditions were therefore very unfavorable: but, notwithstanding this, I immediately secured a good 'set,' and the young oysters grew with remarkable rapidity, on account of the abundant supply of food and fresh water which gained ready access to all of them, and the uniform temperature which was secured by the constant change of water.

This method of oyster culture may be applied in many ways, of which the most obvious is the production of seed oysters for planting.

The 'seed' which is used for planting in Maryland and Virginia, as well as in Delaware and farther north, is now procured from the natural beds of our waters by tonging or dredging, and as the demand for oysters for this purpose is certainly one of the elements which have led to the depletion of our beds, there is a wide-spread feeling that the exportation of 'seed' should be prohibited.

By a small investment of capital in floating collectors, any one on tide-water could easily raise large quantities of much better, cleaner seed than that which is now procured from the natural beds; and, if the laws permitted the sale and transportation of this seed without restriction at the season when the demand exists, it could be sold at a profit for less than the cost of tonging.

Northern planters could also raise seed for themselves by constructing floating collectors in the warm water of the sounds of Virginia and North Carolina, where the length of the summer would permit several collections to be made in one season. The oysters thus reared are large enough for planting in five or six weeks, and in the latitude of Beaufort there is an abundance of spat from the middle of April to the first of July, and it can be collected until September.

The method may also be used by planters for collecting their own seed, especially in regions remote from a natural supply. If there are no oysters near to furnish the eggs, a few spawning oysters may be placed among the shells in the collector, after the French method, to supply the 'set.'

It can also be used for the direct production of marketable oysters, especially over muddy bottoms, and in regions where public sentiment does not permit any private ownership of the bottom.

As food for the oyster is most abundant at the mouths of muddy creeks, where the bottom is too soft for oyster culture by planting or by shelling, this method will have especial advantage in such places; for there will be no danger of sanding or of smothering by mud at the surface, and there is no limit to the number of oysters which can thus be grown on a given area, for the free current of water will bring food to all of them.

The very rapid growth will more than compensate for the cost of the floats, and Mr. Armstrong's experiment shows that, in addition to all these advantages, the oysters are of a better shape, with better shells, and more marketable, than those grown at the same place on the bottom.

Finally, this method will do away with the necessity for a title to the bottom, and will thus enable a few enterprising men to set the example of oyster culture, and, by the education of the community, to hasten the time when wiser laws will render our natural advantages available for the benefit of our people.

The most economical method of constructing floats must, of course, be determined by practical experiments; but a float constructed by connecting two old ship-masts together by string pieces, with a bottom of coarse galvanized iron netting, would have sufficient buoyancy, and enough resistance to water, to support a large quantity of submerged shells and oysters for two or more seasons, and a coating of copper paint each year would protect the timbers from worms.

The floats should be open at the ends to permit free circulation, and they should be moored in such a way as to swing with the current.

Engagement in business projects is no part of the office of a university, and I feel that the experiments of the past summer have brought the subject of oyster culture to a point where its further development should be left to those who are p

ANTI-CHOLERA INOCULATION.

DURING the past summer the public has been made aware, through the medium of the newspapers, that a certain Dr. Jamie Ferran, hitherto unknown to fame, professes to have discovered a safe and certain method of securing immunity against Asiatic cholera by a process analogous to vaccination.

As most people know, the researches of Pasteur, Koch, and others, have, within the last few years, made it seem extremely probable that the whole class of contagious or zymotic diseases is the direct result of the growth in the body, and particularly in the blood, of certain exceedingly minute micro-organisms called bacteria. Each of these diseases is supposed to be caused by its own peculiar species of bacterium, and the course of the disease is understood to end when the supply of the peculiar element necessary to the growth of these bacteria is exhausted. If this element is one that cannot be reproduced, the disease cannot recur; and if by any means we can remove this element, and keep it removed, we can prevent the attack of the disease. This is what has been done in case of small-pox, and this is what Dr. Ferran claims to have done in case of cholera.

In considering the truth or falsity of this claim, three questions arise: First, Is cholera caused by the growth of micro-organisms in the body, and, if so, is it possible that the element necessary to their existence can be removed? Second, By what means does Dr. Ferran claim to have removed this element? Third, What has been his success?

From the researches of Koch and others, it does seem probable that Asiatic cholera is caused by the growth of the comma bacillus in the intestinal tract and in other parts of the body; for it has been shown that this bacillus is always present when cholera is present; that it is never found in the body unless cholera is present; and that in all probability its injection into the intestine would cause the appearance of cholera.[1] But there seems to be little reason to suppose that the element of the body which constitutes the proper food of the comma bacillus can be, at least permanently, re-removed; for one attack of cholera affords no immunity against a second. In justice to Dr. Ferran, however, it should be said that he only claims that his system affords temporary protection.

The means by which this protection is said to be secured are as follows: By methods only known to the discoverer, the comma bacillus is so cultivated that its spores are produced. From these spores, which are capable of enduring conditions that would prove fatal to the bacilli themselves, mulberry-like masses form, and these masses, in turn, give birth to a generation of true bacteria.[1] By introducing into the circulation a small quantity of liquid containing these spores, mulberry-like masses, bacilli, etc., it is said that those elements on which the comma bacillus feeds can be removed from the blood without much constitutional disturbance, thus securing immunity against an attack of cholera until these elements can be renewed.

But, to say nothing of the suspicious secrecy with which all this process is surrounded, it seems certain, from the reports of those who have sought to investigate or repeat Dr. Ferran's experiments, that he is entirely ignorant, or at least careless, of the nice technical details necessary to success in the study of bacteria, and that his so-called spores are sterile and disorganized products,[2] and therefore incapable of exerting any salutary effect as an anti-cholera inoculation.

The results obtained by Dr. Ferran in his experiments are more difficult to criticise than either of the preceding questions; for almost all that is known about these results is what he has chosen to tell, and his personal equation, so to speak, is an unknown quantity, unless it can be inferred from the character of a man who acknowledges himself willing to keep secret a certain means of securing safety from the attacks of a disease like Asiatic cholera, for the simple reason that he has not yet secured a suitable pecuniary reward.

His method of procedure seems to be about as follows: From twenty to fifty francs are first collected from the person who is to be inoculated. Then about one-half a cubic centimetre of the inoculating fluid is injected deeply into the outer and back part of the upper arm by means of a common hypodermic syringe. The results of this injection are, according to Dr. Ferran, local pain and swelling and slight constitutional disturbances, — fever, diarrhoea, etc., — all passing off in from twelve to twenty-four hours. This is followed by a re-inoculation at the end of about eight days, the same quantity of virus being injected subcutaneously. The patient thus treated is said to be safe from an attack of cholera for a considerable length of time.

Some of those who have visited Spain during the past year to investigate these experiments confirm these statements;[3] others say[4] that deep

[1] It seems probable that, in Dr. Klein's experiments to show the harmless nature of the comma bacillus, his methods of cultivation had rendered the organisms innocuous.

[1] *Zeitschr. klinisch. med.*, ix. 361-373.

[2] Virchow, *Deutsch. med. wochenschr.*, xi. 342.

[3] Van Ermingem, *Deutsch. med. wochenschr.*, xi. 498.

[4] *Brit. med. journ.*, June 9, 1885.

microzyma, septicæmia, pyæmia, etc., are caused by these microzyma. But as these dire results are mentioned by only one writer, and are explicitly denied by other unprejudiced witnesses, they seem hardly worthy of credence. It furthermore seems certain that no one has contracted cholera by being inoculated according to Ferran's method.

When we come to consider the statistics as returned by the French and German officials who have been sent to Spain to investigate Dr. Ferran's experiments, we find numerous obstacles in the way of arriving at a satisfactory conclusion. In the first place, there is no accurate census report in which to base the calculations; in the second place, the number of inoculations actually performed is not exactly known by any one except Dr. Ferran, and it is chiefly from him that our information comes as to the relative number of deaths and inoculations; and, in the third place, the total number of deaths is not known with any certainty. Yet the figures are of some interest, as showing what those who have had the best opportunity to investigate the matter think of the efficacy of anti-cholera inoculation as practised in the villages of Alcira (c. Alberique (b. and Algemesi (c. They read as follows: —

	Population (Official Census).	Population (Estimated).	Non-inoculated.				Inoculated.				Re-inoculated.			
			Number.	Deaths.	Attacks.	Deaths.	Number.	Attacks.	Deaths.		Number.	Attacks.	Deaths.	
a	18[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
b	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
c	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	

It will be seen from these figures that Dr. Ferran succeeded in his experiments more successfully, and, if it must be proved that these statistics were accurate, a very strong point would certainly be made in favor of anti-cholera inoculation. For it would be almost inconceivable that chance should give results very far from the truth, when so many thousands of individuals were concerned. But when we consider the *great* improbability that a disease which in its first attack renders an immunity against a second attack can be guarded against by any form of inoculation, and when we consider the almost nature of the process by which this wonderful result is said to have been reached, and the character of the man who says he has reached this result, the inference seems very near that there is something wrong with the statistics. In other words, it seems more reasonable to suppose that Messrs. Brunedel, Chur-

rin, Albarran, and others have been mistaken or deceived in regard to the facts, than that anti-cholera vaccination as practised by Dr. Ferran is a success.

F. S. BUMPUS.

THOMAS BLAND.

THIS well-known naturalist, after an illness of some two years' duration, died August 30, 1885, in Brooklyn, N.Y.

He was born in Newark, Nottinghamshire, England, October 4, 1809. His father was a physician, and his mother related to Sheppard, the naturalist. He was educated at the Charter house school, London, and had Thackeray for a classmate. Subsequently he studied and practised law. He went to Barbadoes, West Indies, in 1842, and later to Jamaica; visited England in 1850, and in the same year accepted the superintendency of a gold mine at Marmato, New Grenada. While a resident of Jamaica it was visited in 1849 by Prof. C. B. Adams of Amherst, and stimulated by his friendship and enthusiasm, Bland began those investigations of the land-shells for which he afterward became so distinguished. In 1852 he came to New York, which, for most of his subsequent life, became his home. Mr. Bland was of a genial and rather grave demeanor, but notably courteous, and always ready to assist young students or others interested in his favorite pursuit. In spite of his extreme modesty, Mr. Bland was several times called to posts of honor and responsibility. By those privileged to know him, he was held in high esteem, which was increased by his heroism under tribulation and poverty during his later years.

Mr. Bland was the author of more than seventy papers treating of the Mollusca, especially of the United States and the Antillean region. His work was not confined to description of species, but comprised valuable contributions to their anatomy, classification, geographical distribution, and the philosophy of their development. No American student has shown a more philosophic grasp of the subject, and his discussion of the geographical distribution of the land-shells of the West Indies, published in 1867, gave him a wide reputation. He several times returned to this subject in later years, and always with marked success. Since 1869 Mr. Bland was associated with Mr. W. G. Binney in several important works, especially the "Land and Fresh-water Shells of North America," issued by the Smithsonian Institution. Mr. Bland was a fellow of the Geological Society, and an active member for many years of the New York [illegible] of Natural History. A [illegible] has [illegible] ge [illegible]

SCIENCE.

FRIDAY, NOVEMBER 20, 1885.

COMMENT AND CRITICISM.

THERE WAS A REPORT last summer in the foreign journals that the Portuguese government had bought twelve hundred slaves of the king of Dahomey. It was expected that this report would be met by a prompt denial. The Portuguese journals admit the purchase, but state that these slaves were prisoners of war taken by the sovereign of Dahomey, and were about to be put to death on the occasion of a grand *fête* prepared by the king; that, when the Portuguese heard of this projected hecatomb, they sent a ship with agents to Dahomey, as a philanthropic act, and for the benefit of the blacks; that by appealing to the cupidity of the king, they purchased them, not as slaves, but as free men, to work under a contract, for a period of three years, in the cultivation of the coffee plantations on the Island of St. Thomas, after which they will receive regular wages. The continental journals reply that this is only another name for slavery, and will be the most effectual means of perpetuating the traffic in Africa; that if there are no buyers, there will be no slaves; that the African regards the slave as much an article of commerce as ivory, india-rubber, or palm-oil, but prefers the slave as acquired with greater ease; that the king of Dahomey will at once send his warriors into the interior of Africa, to capture more slaves in the place of those that are sold, and if Portugal will buy these, a perpetual traffic in slaves will be established; that this will put an end to all hope of the civilization of Africa, as it must lead to a constant state of war, the trade in slaves paying better than any other.

THE COMING MEETING of the American public health association in Washington, Dec. 8–11, promises to be one of unusual interest. When it adjourned last year at St. Louis, it was expected that the principal subject for consideration this year would be cholera; but fortunately the anticipated epidemic has not appeared, and other topics will therefore be discussed. The leading feature will be the award of prizes for the best essays on the following subjects: Healthy homes and foods for the working classes, The sanitary conditions and necessities of school-houses and school-life, Disinfection and individual prophylaxis against infectious diseases, and The preventable causes of disease, injury, and death in American manufactories and workshops, and the best means and appliances for preventing and avoiding them. The prizes amount to $2,800; $500 for the first, and $200 for the second. The money is the gift of Mr. Henry Lomb of Rochester. For these prizes fifty-two essays have been presented.

TO ANY ONE NOT FAMILIAR with the history of the Smithsonian institution, and the manner in which its natural history collections were administered in the days before the national museum was adopted by congress, it seems almost incredible that there should not have grown up under its care an extensive collection of insects. Still more strange must it appear that an establishment so rich as is the national museum in other branches of zoölogy should have been up to this time without a regularly organized department of entomology. The reasons for this it seems unnecessary to discuss in this place, further than to remind our readers that until very recently all collections and plants received by the Smithsonian institution have been turned over to the department of agriculture for administration. When it is remembered that the national museum was never recognized by that name in any act of congress until 1877, and that its present organization dates back only four years, some deficiencies may well be overlooked. The lack of a department of insects, established upon a permanent basis, has from time to time been made the subject of remark in the columns of *Science*, and it gives us pleasure to announce that steps have been taken toward the stable organization of such a department. It has already assumed an importance not unworthy of the dignity of a national institution. The gift by Dr. Riley of his fine private collection affords a nucleus around which materials will rapidly accumulate, and the appointment of a paid custodian of the collection will cause entomologists to feel that their specialty is to be properly represented in Washington.

THE RECENTLY ANNOUNCED FAILURE of the natural gas-wells of Champaign, Ill., indicates that the supply in the vicinity of Pittsburgh and elsewhere may not be inexhaustible, and may have aroused anxiety in the minds of those who have invested in this new form of enterprise. There is a great deal to be learned in regard to petroleum and natural gas, but a few points as to their origin and mode of accumulation may be counted settled. They are derived from organic matter distributed through the rocks in which they occur: in other words, they are fossil fuel, as really as coal or lignite. They were accumulated in subterranean reservoirs, which are mainly porous sandstones or limestones, covered with impervious shales: and there is no reason to believe that these accumulations are of recent date. A gas-well or oil-well can no more be 'inexhaustible' than a coal-mine. While oil is mobile, and can be drawn through the rocks for some distance to the point of delivery, gas is still more mobile, and may travel farther; but the supply of either or both from a given area is limited and definite. Single gas-wells will fail like single mines, but the *field* may last for a long time. The first anthracite mined in Pennsylvania was opened in a pocket of large extent. The proprietors counted it 'inexhaustible,' and a panic seized them when they found the rock floor beneath it, at no great depth. But a good deal of anthracite has been discovered since. The failure of one set of gas-wells has but little bearing on the life of another set, with other sources of supply, with other sorts of reservoirs, and with other conditions as to depth and geological structure.

THE PRESIDENCY OF THE ROYAL SOCIETY OF LONDON.

THE announcement in *Nature* (Nov. 5) that Professor Huxley has definitely resigned his position as president of the Royal society of London, and therefore as *official* leader of British scientific workers, will cause much regret not only in Great Britain and Ireland, but on this side of the Atlantic. This regret is increased by the further statement that the resignation was due to ill health, which made complete freedom from official cares desirable. The president of the Royal society has manifold and anxious duties. It devolves on him to present the claims of British science to the government, and he is officially responsible for the proper expenditure of the annual grant made by the nation to the Royal society, for the furtherance of scientific research. He is, moreover, in a certain sense, the official adviser of the government in matters which involve scientific questions. Not technically a secretary of state, and fortunately without any political affiliations, upon him devolves, nevertheless, the duty of advising the cabinet on matters pertaining to science, and as to the selection of *regius* professors in scientific subjects in English, Scotch, and Irish universities. Of late years such official duties have been made more onerous by the anti-vivisection act, which names the president of the Royal society as one of the few persons who are entitled to certify that they believe the performance of experiments on the lower animals is justified by the aim of a particular research, and the character and training of the person who desires to make it.

In addition to the above official duties and anxieties, the president of the Royal society has exacting social claims. It devolves on him to see that distinguished foreign scientific men who may visit London are suitably entertained, and introduced to those whom they may desire to meet. The position, though, we believe, unpaid, is one of great responsibility, and involves much labor; and it is an open secret that Professor Huxley assumed it on the understanding that the secretaries should take the main bulk of the necessary work off his shoulders. His researches, his eloquence, his great 'common sense,' made him the natural head of British scientific men; and we trust that the day is far off when we shall cease to learn from him. We expect, now that he is set free from all routine duty, that we shall find him even more a protagonist than we have in the past. We hope that the newspaper rumor is true, and that he is coming to the United States to study the collections of fossil birds and reptiles gathered by Professor Marsh of Yale college, and give us, as no other is so competent to give, a statement of the bearing of these collections on the general doctrine of evolution. Should the master come to rest and work among us, he will surely meet a hearty greeting.

Professor Huxley was for several years the biological secretary of the Royal society. According to *Nature*, his successor is to be Professor Stokes of Cambridge, who has for many years been the mathematico-physical secretary. Who is to be the successor of Professor Stokes as secretary we do not know; but it is interesting to note that

as the Royal society started with a close affiliation to Oxford, then became, as regards its officers, for many years a London society, it now returns from London to one of the older universities for its officers. If Professor Stokes be made president (an honor which is certainly due him), the president and one of the two secretaries will be Cambridge men. This is an interesting example of the fact that the older English universities, now that they have been legally set free from ecclesiastical control, are coming to the front in scientific research. It gives point to the agitation now in progress in London for a 'teaching' university, and shows, that, once ecclesiastical fetters are removed, even the most ancient educational endowments can produce national leaders in the physical and biological sciences.

THE NOVEMBER MEETING OF THE NATIONAL ACADEMY OF SCIENCES.

THE meeting of the National academy of sciences, held this autumn in Albany, though even smaller than usual at this season, was interesting and successful. The meeting began on Nov. 10, and lasted four days. Only 18 of the 97 members were present, and 22 papers were read, 16 of them by members of the academy. The papers elicited an unusual amount of interesting discussion, and the sessions, held in the new and cheery assembly parlor at the capitol, were largely attended by the citizens, who, indeed, did every thing to make the meeting of the academy a pleasant one, with dinners and evening receptions. The local scientific institutions combined to receive the academy on the first evening, and the assemblage at Geological hall was a large and distinguished one.

Although the papers were divided almost equally between the physical and natural sciences, those in the former department were, generally speaking, both more important and of wider interest. They were almost exclusively astronomical; and prominent among them, as opening new fields of research, were the papers of Professors E. C. Pickering and S. P. Langley.

The former presented to the academy the results of researches he had undertaken in stellar photography in connection with his brother, Mr. W. H. Pickering, aided by a grant from the Bache fund of the academy. He clearly proved that owing to the recent improvements in photographic methods, and particularly by the advances in dry-plate manufacture, we had now a new tool in astronomy of the utmost importance. The first stellar photographs ever taken were those of α Lyrae by the elder Bond, at the Harvard observatory, in 1850. In 1857 his son carried similar investigations much further. At first, however, they had been unable to obtain clear images of stars of the second magnitude, while now it was possible to print those of the fourteenth, or, in other words, to transfer to paper an image produced by an object only a hundred-thousandth part as bright as formerly. Professor Pickering's researches were carried on by means of a new instrument he had devised and constructed from the Bache fund, in which a photographic lens of eight inches aperture and forty-four inches focus is mounted equatorially, and moved by clock-work. By disconnecting the clock-work, photographs of several different regions may be taken upon the same plate, and the stars distinguished by varying the exposures.

Three different fields of investigation were here opened, each of which had been traced somewhat by way of exploration. One was a map of the heavens; a second, the study of atmospheric absorption; and the third, the study of stellar spectra, which, by these methods, may now be pursued with comparative ease. It was found that the negatives would show the lines of stars of the eighth magnitude perfectly, and that these spectra would even bear enlargement upon paper with clear definition. As the only limit of the further extension of stellar photography is the sensitiveness of the dry plate, and as this limit is plainly not yet reached, even better results may be expected.

Many photographs were exhibited, and great interest was manifested in this new departure, as well as in the simple, effective, and time-saving devices of the author for direct comparison on the same plate of a large number of objects for photometric purposes.

Professor Langley's paper related to 'obscure heat,' and continued, as was expected, his remarkable researches with the bolometer, by which he has so greatly extended our notions of the invisible spectrum. This time he dealt with the lunar spectrum, and estimated the heat derived from the unillumined moon. Rosse had estimated the temperature of the moon's surface as from 200 to 500° F. By studying the moon at its full with a rock-salt prism obtained only after repeated failures, and which, from its nature, had already required repolishing seven times, each time necessitating a new determination of its constants, he had succeeded on repeated occasions in securing a spectrum which showed two curves, — one according with that previously obtained in the infra red region beyond the visible portion of the solar spectrum, and clearly due to reflection; and another, lying entirely beyond that, as clearly due to the moon itself, and revealing its real temperature.

This, as shown by studying the spectrum of frigid masses, is colder than the temperature of melting ice.

By comparing the mean of the spectra obtained in summer with that of those obtained in winter, it is evident that a much greater amount of heat is received from the moon in winter than in summer. This may simply be due to the greater amount of aqueous vapor in our own atmosphere in the summer, as contrasted with the winter clarity. By directing the bolometer to the zenith and to the horizon, the temperature of space has also been measured by direct experiment for the first time, and the amazing transparency of our atmosphere to radiation of the earth's heat revealed; for his experiments show that our atmosphere transmits the earth's heat more readily than the sun's.

Professor Newcomb discussed the subject, 'When shall the astronomical day begin?' He took the ground that the inconvenience arising from the discordance between the civil and astronomical measure of time had been greatly exaggerated. It depended, not upon the number of people who had to use the one time, nor upon the number who had to use the other, but upon the number of times one had to be changed into the other. As an illustration, he said that the inhabitants of the planet Mars might use one reckoning of time, and we another, without the slightest inconvenience to the inhabitants of either planet. On the other hand, the proposed change of the beginning of the astronomical day from noon to midnight would be productive of confusion both to ourselves and our successors, the end of which it would be hard to see. It was, in fact, nothing less than a change in language: it was proposed that 'three hours mean time' should hereafter mean what 'fifteen hours' had hitherto meant, and *vice versa*. He explained, however, that his objections applied only to that resolution of the International conference which proposed to change the beginning of the local astronomical day to midnight, and that he made no objection to the introduction into astronomy of the universal day, beginning at Greenwich midnight, provided that this reckoning of time was expressed in language which would clearly distinguish it from any other.

Professor C. H. F. Peters sustained the view of Professor Newcomb, while Professors Young and Graham Bell opposed it. Professor Young held that the introduction of civil time into astronomical reckoning would be a great convenience in designating without ambiguity the times of observations, especially those made in the forenoon; he cited cases in which correspondents had written to him to inquire on which day such observations had been made. He considered that the public at large were ready to adopt the recommendations of the International conference, and that astronomers should not be behind them in doing so.

Professor Bell held that there were three strong reasons for the adoption of the change. The first was that the Meridian conference which proposed it was called by our government, and that we were bound to follow its recommendations. Another reason was that the astronomer royal at Greenwich had adopted the new reckoning at the beginning of the present year, so that the reform was secure if Americans would only follow his example. Third, he considered that ambiguity would be avoided in the records of astronomical or other events. For example, beginning the day at noon, it might happen that an eclipse of the sun occurred before noon at one place, and after noon at a place farther east. Then the historian of the future might be perplexed by finding the eclipse recorded in one place as beginning on one day, and in another place as beginning on the day after.

In reply to Professor Bell, Professor Newcomb called attention to the case when an eclipse of the moon would be observed before midnight at one place, and after midnight at another. So that if the day began at midnight the same trouble would arise that Professor Bell had pointed out in regard to the solar eclipse.

In reply to Professor Young, he said that in order to bring the astronomical and civil reckoning of time into accord it was necessary either that astronomers should subdivide the day into A.M. and P.M., or that the general public should count the hours up to twenty-four. He considered neither course feasible.

Other astronomical papers were read by Mr. O. T. Sherman, who exhibited spectra of β Lyrae and γ Casseiopeiae, showing the existence of bright lines which coincide closely with those of the solar chromosphere; by Prof. C. H. F. Peters, who believes that he has been able to make a plausible hypothesis for each of the twenty-two stars observed by Flamsteed, which were afterwards supposed to be lost; and by Prof. C. A. Young, on the fading star in the nebula of Andromeda, which he had found also to be of variable color.

On the biological side, the chief interest centred in the exposition, by Dr. A. Graham Bell, of the first results of the investigations it had been known he was making in hereditary deafness. A report of this paper will appear in *Science* of Nov. 27.

Space prevents our entering into detail concerning other papers which had mostly only a technical interest. A complete list will be found in our notes. The next meeting will be the annual session at Washington, in May, 1886.

ENTOMOLOGY IN THE NATIONAL MUSEUM.

ALTHOUGH the department of insects in the national museum was organized three years ago, little has hitherto been attempted beyond the caretaking necessary for the preservation of the material already on hand; the honorary (or unpaid) curator of the department, Dr. C. V. Riley, having had comparatively little aid from the museum appropriation in the matter of construction of cases or the employment of assistants. At the beginning of the present fiscal year a salaried assistant-curatorship was established, to which Mr. John B. Smith was appointed. Additional accommodations in the laboratory and exhibition hall have been provided, and the study-collections and the exhibition series are now being rapidly extended.

In October Dr. C. V. Riley formally presented to the museum his private collection of North American insects, representing the fruits of his own labors in collecting and study for over twenty-five years. This collection contains over 20,000 species, represented by over 115,000 pinned specimens, and much additional material unpinned and in alcohol.

This generous gift to the government has long been contemplated by Dr. Riley, whose ambition it is to be, so far as possible, instrumental in forming a national collection of insects, and with the belief that his collection will form an excellent nucleus for future accumulations. In his letter of presentation he remarks, —

"While the future of any institution dependent on congressional support may not be so certain as that of one supported by endowment, I make this donation in the firm belief and full confidence that the national museum is already so well established in public estimation that it must inevitably grow until it shall rival and ultimately surpass other institutions in this country or the world as a repository of natural history collections.

"If there shall in the future result the concentrating here at the national capital of the extensive entomological material which naturally comes here, and which in the past has been scattered among specialists in all parts of the country, so that in the future the student may find valuable material to further his work in any order, I shall feel amply rewarded for the action I have taken."

A recent census of the national collection of insects has been taken, the specimens in each box having been counted. A summary of the results follows: —

The collection of Dr. C. V. Riley. — This collection contains the following pinned and mounted specimens:

	Boxes.	Specimens.	Species.
Hymenoptera	66	24,796	2,650
Coleoptera	127	43,613	6,558
Lepidoptera	338	17,098	2,308
Diptera	21	5,646	699
Hemiptera	59	8,862	1,184
Orthoptera	64	6,903	580
Neuroptera	14	868	169
Arachnida and Myriopoda	2	425	110
Insect architecture	16	1,080	178
Miscell. (not yet arranged)	28	1,610	178
Galls and gall insects	31	4,152	784
Total, pinned	766	115,058	15,328

The collection also contains some 2,850 vials of alcoholic material, chiefly of the adolescent states of insects, in many cases several species being contained in a single vial. The early states of the minuter insects are mounted in balsam on slides, of which the collection contains upward of 3,000, most of the slides holding the contents of three cover-glasses.

The mounted specimens are all duly classified and labelled, and in excellent order and preservation. The labels include notes as to locality and food-habit, and are also in many cases numbered to correspond to detailed notes as to adolescent states and habits. The collection embraces few exotic species, and is more particularly rich in biological material, containing more blown and alcoholic larvae and pupae in connection with their imagos than perhaps any other collection of North American insects. Including the unarranged and alcoholic material not connected with the pinned specimens, there are over 20,000 species in the collection.

Collection of the department of agriculture. — This collection comprises some 500 folding boxes, and 123 odd boxes, many of them but partly filled, and duplicating in a great measure those in the Riley collection. It also contains a large assortment of slides and alcoholic specimens accumulated during the past seven years.

Three hundred of the folding boxes contain a tolerable, classified collection, chiefly of Coleoptera and Lepidoptera. The other boxes contain all the more recent material collected for, or reared at, the department, and include the Brazilian collection of Dr. J. C. Branner and Mr. Albert Koebele. This material is separated by orders, but not yet carefully worked over or classified. They also include some few purchases from Messrs. H. K. Morrison and Wm. Wittfeld, the exotic Coleoptera from the administrators of the Belfrage estate, and the Burgess collection of Diptera.

This collection includes many undescribed species in all orders; and a rough estimate indicates that there are about 50,000 specimens, and probably 5,000 species, mostly exotic, not in the Riley collection.

The collection of the national museum proper. — This comprises all the material received during

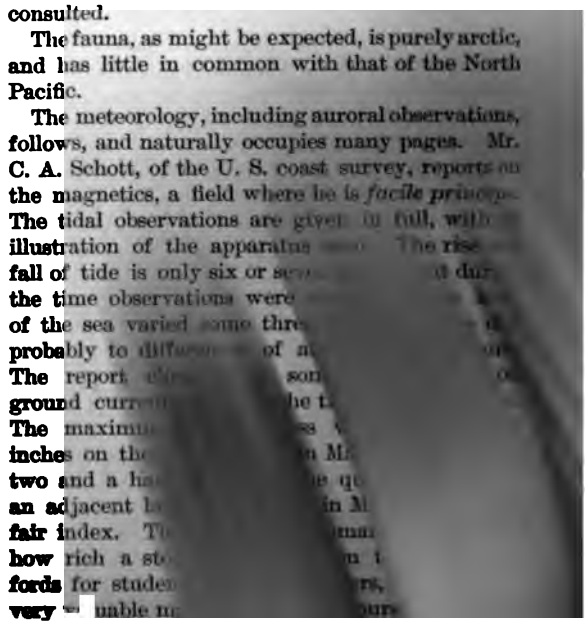
the past three years. There are some 50 folding boxes, and some half dozen drawers of pinned and mounted specimens. These consist chiefly of exotic species, and mostly of the showier Lepidoptera sent to the museum because of their brilliancy, and without name. There are also about 100 bottles of various sizes, containing alcoholic material, much of it exotic, and considerable material of value as illustrating insect architecture. A rough estimate shows about 20,000 specimens, and 2,000 species not in the other collections.

Exhibit collection of economic entomology. — This collection, prepared for the New Orleans exposition, and a catalogue of which has been published, will be deposited in the museum. It is made up of the following sections: 1°. Insects injurious to agriculture (arranged according to the particular plant, and the particular part of the plant, affected). 2°. Insecticides. 3°. Insecticide machinery, and contrivances for destroying insects. 4°. Bee-culture. 5°. Silk-culture.

From the above statement it is evident that there are already something like two hundred thousand mounted specimens in the national collection, comprising some twenty-six thousand distinct species. This, together with the vast amount of alcoholic material already indicated, will serve to show its fulness.

REPORT OF THE POINT BARROW STATION.

This volume, which contains the report of Lieut. Ray's party at Point Barrow, 1881–83, is notable in several respects, and creditable to all concerned. It has been prepared by Lieut. P. H. Ray, U.S.A., and Prof. John Murdoch of his party, with the assistance of several experts. It is not necessary to rehearse the object and relations of the expedition, which have been repeatedly referred to in the pages of *Science*. The report begins with a statement of the orders and instructions under which the work was done. This is followed by a narrative by Lieutenant Ray of the transactions at Point Barrow, or rather the station Uglaāmi near the Point, of his explorations of the Meade River, and of the voyage to and from the station. This narrative is unpretentious and interesting, and terminates with a hearty recognition, by the commander, of the qualities shown by the members of his party during the monotony and privation of their long exile. Lieutenant Ray also furnishes an ethnographic sketch of the natives of Point Barrow, which will be found entertaining reading, and is illustrated by some excellent heliotypes, — the best, indeed, we have seen from photographs made in this part of the arctic regions. They give very satisfactory views of the station, the grounded ice, the natives of Uglaāmi, and of the village of Ilĭūlĭūk, Unalashka, at which the expedition touched. There is also a census and vocabulary of the Innuit of Uglaāmi, and a list of the ethnological specimens obtained by the party, to the illustration of which several plates are devoted. Part iv. contains the natural history prepared by Professor Murdoch, assisted by Professors Asa Gray and C. V. Riley, Messrs. Fewkes, Dall, and others. The Innuit name of each animal is appended when known. The mammals, birds, and fishes are treated by Murdoch, and illustrated by two very successful colored plates of the beautiful rosy gull, Rhodostethia rosea. Professor Riley contributes some notes on the scanty representatives of insects; Professor Gray, others on the plants; Fewkes and Dall report on the acalephs and mollusks respectively; while Murdoch discusses the other marine invertebrates, especially the crustacea, of which some new species are described and illustrated. With the mollusks is given a heliotype plate of some critical species of Buccinum, with magnified drawings of the minute surface sculpture. The collection afforded several new forms of shells. There are notes on the collecting stations, and a useful bibliography of works consulted.



The fauna, as might be expected, is purely arctic, and has little in common with that of the North Pacific.

The meteorology, including auroral observations, follows, and naturally occupies many pages. Mr. C. A. Schott, of the U. S. coast survey, reports on the magnetics, a field where he is *facile princeps*. The tidal observations are given in full, with illustration of the apparatus. The rise fall of tide is only six or seven dur the time observations were of the sea varied some three probably to differences of a The report son ground curr he t The maxim inches on the in M two and a ha qu an adjacent in M fair index. T mum how rich a st n i fords for stude rs, very unable n ours

Report of the international polar expedition to Barrow, Alaska. Washington, Government, 1885. 4 illustr. 4°.

y collections, and so prompt and useful a uld not have come about without quali- igh order in both the party and its chief. magnetic and astronomical observations precise than could be wished seems to the result of circumstances beyond the the members of the party.

HORSE-BREEDING.

ASONIERE has written a very sensible upon horse-breeding, which has been with a medal by the French national al society. He gives first a discriminat- nt of the points which mark a good then proceeds to characterize the two equine types, *speed* and *strength* being ective characteristics, or, according to elaborate definition, 'type à étendue de n' and 'type à intensité de contraction.' al idea as to the breeding is that the two uld not be mingled, because in the off- congruity results, one part of the animal its qualities from the mother, another the father. The wisdom of this precept es by a discussion of the rules to be fol- the amelioration by breeding of special he animal, and maintains that injudi- ing of the two types produces horses of ruous build. To put the matter more o get good colts the mare and stallion semble one another, else the colt will be odge of qualities not harmonious.

atise is pleasantly written, and, though erly a scientific work, is still valuable may be pardoned the phrase, its good se, and we take pleasure in commending notice of those engaged in rearing horses ntry.

CTROTECHNICAL HANDBOOK.

TTLER'S book, of which the first part of s just appeared, will be welcomed by who has to do with any of the applica- lectricity to the arts. It begins with a ion of the phenomena and laws of in- iving particular attention to the special t are of importance in the operation of hone and dynamo-machine, and then o discuss at length the various separate he dynamo-machine, and indicates the ecially to be observed in their construc- tion. The circumstances influencing the magnetization of soft iron — as the dimensions of the piece, the strength of the magnetizing current, and the quality of the iron — are next analyzed. Most of the remainder of that portion of the book as far as issued is occupied by a lengthy and detailed description of the principal forms of electrical measuring instruments. Their theory and construction are somewhat minutely considered, and most of the important special forms of instrument are figured. A list of a few of these will best show the character and completeness of the work. We notice, among others, Kohlrausch's bridge for use with a telephone, Siemens's modification of Thomson's bridge for measurement of low resistances, several forms of Wiedemann's galvanometer with copper dampers, Obach's cosine galvanometer, Siemens and Halske's convenient form of Thomson's mirror galvanometer, and D'Assarval and Deprez's aperiodic galvanometer. All of the leading forms of current and potential galvanometers for technical purposes are described, including several which we have not seen elsewhere, except in the original papers.

The work is written (as should be the case with a work of this kind) for students possessing a good knowledge of physics and mathematics. It would be of great advantage to American students of electrotechnics if some of our publishers would issue a translation of this work. We are sure that it would meet a much-felt want.

FROM PALERMO TO TUNIS.

ONE of the pleasantest of the many delightful trips aside from the beaten track—to which Americans in Europe carefully cling—is that from Naples to Tunis by way of Palermo and Malta. Besides seeing the Sicilian capital—a splendid city in itself and renowned throughout Italy for the beauty of its women—and Malta, the dwelling place of one of the most remarkabls races of the Mediterranean, one gets a glimpse of oriental life in all its filth and picturesqueness for a fraction of the time and money required for a visit to Cairo or Constantinople.

With regard to Malta, the fact which most impressed itself upon M. Melon's note-book—for this little volume pretends to be nothing but a collection of notes—was the signal failure of the English to assimilate the native population. To use his own words: "After eighty years of domination the line of demarcation between the Maltese and the English, their masters, is as sharply defined as on the first day." The greater

tion de l'espèce chevaline par des accouplements Par L. ALASONIERE. Paris, *Baillière*, 1885. 15+156

h der elektrotechnik. Bearbeitet von Dr. E. Stuttgart, *Enke*, 1885. 8°.

De Palerme à Tunis. By PAUL MELON. Paris, *Plon, Nourrit & Cie*, 1885. 212 p., illustr. 12°.

part of the book, however, is devoted to a description of Tunis and neighboring towns. Of course whatever a Frenchman writes about such a recent acquisition as Tunis must be received with caution, and much that is here said about the Roman ruins is probably exaggerated. The old Phoenician Carthage has entirely disappeared, and of the Roman town but little remains. Utica, too, is no more to be seen, and, in fact, the province of Carthage—once the granary of imperial Rome—is little more than a desert. Still as our author says: "Although there is scarcely a vestige of Carthage remaining, its site alone attracts the tourist to the top of the ancient Brysa." In conclusion, it may not be amiss to point out that the traveller who designs visiting Tunis for the sake of viewing eastern barbarism would better bestir himself, as the French are reported to be improving the place in the true Parisian fashion.

GEOGRAPHICAL NOTES.

A DISCUSSION of the hydrographic observations made on the expedition of 1883 to Greenland seas has been published by Nordenskiöld and Hamberg in the Proceedings of the Royal geographical society. There are numerous water sections; and the discussion is of much value and interest for the hydrographer, but too extensive to summarize here.

During the past summer, Captain David Gray, the well-known whaler and explorer, visited the east coast of Greenland at a high latitude. The floes extended this year very far west from Spitzbergen, at least 180 miles at Prince Charles Foreland. In latitude 74° the edge was in longitude 14° W.; and in latitude 71°, in 16° W. In August he sailed along the coast from Shannon Island to the entrance of Scoresby Sound, a distance of three hundred miles, sometimes in sight of the land-water, and sometimes farther off. On the Liverpool coast he passed between the land-ice, but found no whales. The land-ice was sufficiently open for a steamer to have forced her way through it, which is very rarely the case so early in the season.

The Danish expedition to east Greenland has returned to Copenhagen after an absence of twenty-nine months. The latitude reached was 66° 8′, about forty miles farther north than Nordenskiöld's vessel attained in 1883. There have been no casualties, and the health of the party is excellent. Many photographs and interesting ethnological objects were brought back. Lieutenant Holm, commanding, considers that it is now settled beyond a doubt that no early Scandinavian remains occur on the east coast.

'Island, land und leute, geschichte, litteratur und sprache,' by Dr. Ph. Schweitzer, has been published by W. Friedrich in Leipzig. There has been no complete work on Iceland in the German language hitherto; but the present one does not seem in all respects satisfactory, and parts of it are characterized as unscientific and fanciful by German critics.

A very useful and complete atlas of Russia has been prepared by J. Poddubnyi, and published by A. Deubner, St. Petersburg, under the title of a 'Russian school atlas,' at the small price of one ruble. It would seem to be far more than an ordinary school atlas in the sense commonly understood, and to be well worthy a place in the library of all interested in geography; being full of maps showing meteorology, distribution of races, religions, etc., and many diagrams.

J. Hughes and F. Dunsmuir have returned to Juneau, Alaska, from the head waters of the Yukon. They descended the Lewis branch to the Salmon River, which was ascended to its head waters. Good placers were found on the bars. Some twenty prospectors will remain in the region all winter. They were said to average seven or eight dollars a day per man in gold dust. These diggings are mostly in British territory.

News from the whaling fleet to Nov. 3 states that one hundred and seventy-four whales had been taken. No further casualties are reported, and the vessels are beginning to arrive at San Francisco.

Lieutenant Allen and party of the Copper River expedition, now returned, are said to be seriously affected by scurvy, due to their privations.

The revenue cutter Bear, formerly of the Greely relief expedition, has sailed from New York for the western coast, where she will be employed in Alaskan waters on revenue duties, and to assist disabled vessels of the whaling fleet during the season. She will hardly reach San Francisco before February, 1886.

Lieutenant Greely is in Scotland, the guest of Lord Roseberry, and is to deliver an address before the Scottish geographical society Nov. 19. His health is said to be improving.

Dr. Stejneger of the national museum has an illustrated article on the Commander Islands, containing much of interest, in the last number of the *Deutsche geographische blätter.*

ASTRONOMICAL NOTES.

Spectral analysis of atmospheric elements.—M. Janssen announces (*Comptes rendus*, ci. 4 that he has taken up the special study of t sorption spectra of gases, mostly those co

our atmosphere. The observatory at Meudon has special facilities for this work; and already in a tube of oxygen 60 metres long, under a pressure of 27 atmospheres, M. Janssen states that there are absorption phenomena visible beyond A, and some bands in other parts that are not in the solar spectrum. These he attributes to the increase of pressure over that of our atmosphere.

Personal equation in observing circumpolars. — In rediscussing Wagner's Pulkowa transit-observations of Polaris, 51 (H) Cephei and δ Ursae Minoris, to determine the constant of nutation, Dr. L. de Ball finds an interesting and strikingly constant difference between the right-ascensions observed by 'eye-and-ear' and on the chronograph. His results are as follows: —

Method.	α Ursae Minoris.	51 (H) Cephei.	δ Ursae Minoris.
	s. s.	s. s.	s. s.
Eye-and-ear...	38.71 ± 0.048	11.72 ± 0.026	53.08 ± 0.020
Chronographic	39.06 ± 0.051	12.01 ± 0.027	53.36 ± 0.020

The above are the seconds of right ascension for 1865.0.

Latitude of the Bordeaux observatory. — M. Rayet has determined (*Comptes rendus*, ci. 731) the latitude of the new observatory at Bordeaux to be + 44° 50′ 7″.23; but as it rests entirely upon measures of the zenith-distance of fundamental stars, and as there appears to have been no investigation of flexure or of constant error in the nadir-point, it may possibly be in error by some tenths of a second.

Asteroids 251 and 252. — The asteroid discovered by Palisa on the 4th of October (*Science*, vi. 333), while searching for Eudora, turns out to be a new one, and is accordingly number 251. Eudora was observed at Vienna on October 4 — 11.3 magnitude. Perrotin's new asteroid of October 27 becomes number 252.

The total solar eclipse of 1885, September 9. — The last number (835) of *Nature* gives several letters from observers of the recent eclipse of the sun visible in New Zealand. There are no reports from the government parties organized by Mr. Ellery, but it is stated that bad weather seriously interfered with their observations. Mr. Graydon made a series of sketches of the corona from Tahoraite, — a point well within the belt of totality, but some forty miles north of the central line. Five sketches were made during the short time of totality, and their agreement confirms the observer's impression of the fixity of the phenomenon. A woodcut from these sketches shows five or six long rays (besides a large number of shorter ones) projecting from the sun's limb, the longest ray being some two or three diameters of that body in length. A dark rift was observed in the corona, and near this rift a red flame was noticed by some of the bystanders to shoot out just before the end of totality. Ten instantaneous photographs were obtained by a party at Blenheim; and at Mastertton "Messrs. McKerrow and party, who had camped at the foot of Otahuao, proceeded to the top and fixed their instruments amid driving snow and hail." They were rewarded by the sky clearing off just before totality, and four photographs were obtained. Other observations were made at Wellington and Dryertown.

NOTES AND NEWS.

THE following papers were entered to be read at the meeting of the National academy of sciences in Albany, beginning Nov. 10: S. P. Langley, Obscure heat; John S. Billings, A new form of craniaphore, for taking composite photographs; A. S. Packard, The carboniferous merostomatous fauna of America; E. C. Pickering, Stellar photography; E. D. Cope, Two new forms of polyodont and gonorhynchid fishes from the eocene of the Rocky Mountains; (by invitation) O. T. Sherman, Yale college observatory, New lines on the spectra of certain stars; C. H. F. Peters, Certain stars observed by Flamsteed, and supposed to have disappeared; James Hall, Remarks upon the international geological congress at Berlin, with a brief historical notice of the origin of the congress; James Hall, Notes on some points in the geology of the Mohawk valley; Simon Newcomb, When shall the astronomical day begin? (by invitation) William B. Dwight, Primordial rocks among the Wappinger valley limestones, near Poughkeepsie, N.Y.; C. H. F. Peters, The errors of star catalogues; A. Graham Bell, Preliminary report on the investigation relating to hereditary deafness; C. A. Young, The new star in the nebula of Andromeda; (by invitation) J. A. Lintner, Recent progress in economic entomology; J. W. Powell, Remarks on the stone ruins of the Colorado and the Rio Grande; (by invitation) Charles H. Peck, The New York state herbarium; (by invitation) T. H. Safford, The formation of a polar catalogue of stars; (by invitation) Otto Meyer, A section through the southern tertiaries; James Hall, Remarks upon the Lamellibranchiata fauna of the Devonian rocks of the state of New York, and the results of investigations made for the paleontology of the state; J. S. Newberry, Recent discoveries of gigantic placoderm fishes in the Devonian rocks of Ohio; J. S. Newberry, The flora of the cretaceous clays of New Jersey.

— The American public health association will convene at Washington, D.C., Tuesday, Dec. 8,

at 10 o'clock A.M., and continue four days. The meetings will be held in Willard's hotel hall, on Pennsylvania Ave. The executive committee have selected the following topics for consideration at the meeting: 1°. The best form in which the results of registration of diseases and deaths can be given to the public in weekly, monthly, and annual reports; 2°. The proper organization of health boards and local sanitary service; 3°. Recent sanitary experiences in connection with the exclusion and suppression of epidemic disease; also the Lomb prize essays. In addition to other able and comprehensive papers expected to be presented at this meeting, the secretary has received notice of the following: Dr. J. S. Billings, Forms of tables for vital statistics; Dr. E. M. Hunt, Sanitary and statistical nomenclature; Dr. Charles H. Fisher, Statistics of consumption in Rhode Island for a quarter of a century; Dr. E. M. Hartwell, The German system of physical training; Dr. William Oscar Thrailkill, School hygiene, public and private; Dr. Joseph Holt, Sanitary protection of New Orleans, municipal and maritime; Dr. S. T. Armstrong, Maritime sanitation; Dr. P. H. Bryce, Small-pox in Canada, and the methods of dealing with it in the different provinces; Dr. Benj. Lee, The debit and credit account of the Plymouth epidemic; Dr. C. A. Lindsley, An epidemic of typhoid fever; Dr. O. W. Wight, Experiences in disinfecting sewers; Dr. J. N. McCormick, Progress of health work in Kentucky; Dr. Thomas F. Wood, Observation on the Cape Fear River water as a source of water-supply: A study into the character of southern river water; Dr. D. E. Salmon, The virus of hog cholera; George N. Bell, Hygiene of the dwelling; Dr. John Morris, The proper disposal of the dead; Dr. A. C. Bernays, The relation between micro-organisms and cells; Dr. W. H. Watkins, The layman in sanitation; Dr. R. Harvey Reed, Who is responsible for the iniquities of the third and fourth generations, and how shall they be avoided? Dr. W. John Harris, Carelessness the cause of disease. The committee on disinfectants will present quite a voluminous report (printed), embodying their investigations and conclusions on the subject of disinfection and disinfectants.

— The Massachusetts teachers' association will hold its forty-first annual meeting in the Girls' high school building, Boston, on November 27–28. The two volumes recently published by the association — the first a history of the association from its organization in November, 1845, with an abstract of its proceedings (1845–80); and the second a continuation of the above, with the addresses at the annual meeting in 1882 in full — may be obtained at twenty-five cents each, upon application to the treasurer, Alfred Bunker, Boston.

— Prof. E. Hitchcock writes from Geneva, N.Y., to announce that a portion of the skeleton of another mastodon has just been unearthed in Seneca Castle, N.Y., about five miles from Geneva. It was found, as is usual, at the bottom of a peat morass lately drained for farming purposes. The aggravating thing to the naturalist is that the bones most decisive in determining the species were not found, though all were remarkably sound and strong. The left tusk measured eight feet nine inches on its outer curve, and evidently was not the whole tusk. The two styloid bones were well preserved. The rest of the bones were vertebrae, about one-half the ribs, and many of the bones of the hand and foot, but no head or pelvis. The bones were discovered through Mr. F. B. Peck, a senior in Amherst college, and they are the property of this institution. The peat and muck were only three feet thick, which must account for the scarcity of the large bones.

— Capt. Charles Haley, of the schooner Genevieve, recently arrived at Philadelphia from Charleston, S.C., reports that on Oct. 29, at 10.30 A.M., when about thirty miles south of Frying Pan Shoal lightship, he had his main and mizzen masts carried away about twenty feet below the cross-trees. The weather was clear and pleasant, moderate swell, light breeze from W.N.W., and vessel going through the water at about four knots, heading N.E. by E., with all sail set. Noticing a small cloud to windward, of cirro-cumulus formation, and hearing a sizzling sound aloft, he sang out to clew up the topsails. The next moment the topsails gathered up in a bunch, and the main and mizzen masts were twisted off and taken overboard. At the same time the jib and foresail were flapping to windward with each roll, and he could have held an open umbrella over his head, there was so little wind. A few minutes afterward the sun came out bright and clear. About 2 P.M. the same day a gale sprung up from S.W., and blew for twenty hours. The mate said the small cloud that came down from windward looked like the first appearance that a cloud generally assumes when a water-spout is beginning to form.

— A New York *Herald* despatch of Nov. 16 announces that Vesuvius is again in a state of eruption. The lava is streaming down on the west side of the mountain, and some alarm is expressed, as the observatory authorities believe that

the eruption will become more serious than it is at present.

— In the second part of the first volume of the 'Supplementary papers' issued by the Royal geographical society there is a valuable map of central Asia, showing the territory between the Zarafshan and Amu-Daria Rivers. It was compiled from the latest Russian documents to illustrate Mr. E. Delmar Morgan's paper on the 'Recent geography of central Asia from Russian sources.' The map extends only to about 72° 30′ of longitude east from Greenwich, and therefore does not take in the sources of the Amu-Daria or the Oxus. Nevertheless, as it shows the glaciers of Tanimar and Fedshenko, and the hitherto almost unknown mountain regions of Badakshan, Bokhara, and Karateghin, it is of very considerable value. Mr. Morgan's article, containing as it does much information hitherto inaccessible to English readers, should also be borne in mind.

— The French government has just created, says *Nature*, a certain number of travelling-juries. This is a modified form of an institution established by the first republic. In the organic law of the Institut it was ordained that the Institut was to select yearly ten citizens to travel abroad and collect information useful to science, commerce, and agriculture. These scientific travellers will not be appointed by the Academy of sciences, or the whole Institut, but by a special administrative commission, on the basis of a competitive examination.

— A German traveller who has recently visited Macedonia makes, says the London *Times*, the following statement respecting the population of that country: "If people speak of the condition and the movement in Macedonia, they should be reminded that this Turkish province is perhaps the most checkered picture of nationalities of any country in Europe, and that not one of them possesses an absolute majority. In the east, round Salonica, and along the coast, the Greek element is very strong; but even the largest seaport place might be considered a Jewish town rather than a Greek centre. The west is the stronghold of the Albanians,—the most savage, most aboriginal, and most lawless nationality of our part of the globe. A considerable Slav population pushes itself between the Greeks and Arnauts; and distributed among Greeks, Slavs, and Arnauts, we find a large number of Turks and Wallachians. The latter are called in Macedonia mostly Zinzaras, or Tsintsaras, because in their dialect they do not pronounce the number five 'tchintch' (like their kin of Roumania), but 'tsints.' With regard to the number of the population as a whole and separately, it may safely be asserted that the various statements are entirely unreliable, the degree of exactness varying with the views and sympathy of the several authorities who make them. When a Russian general estimates the number of Bulgarians in Macedonia at 1,500,000, this figure may be as much assailed as the claim of the Greek notables when addressing a manifesto to the patriarch and the Porte, to be considered the representatives of 800,000 Greeks living in the province. If Macedonia is mentioned as the seat of political agitation, the Albanian districts of Janina and Scutari must be left out of consideration altogether. The other four great administrative districts remaining — Monastir, Salonica, Kossovo, and Seres — are stated to contain, in accordance with the proportionately most reliable figures, about 1,531,000 inhabitants, who are divided as follows: 410,000 Christian and 46,000 Mohammedan Bulgarians (Pomaks), 350,000 Albanians, 280,000 Turks, 145,000 Greeks, 120,000 Servians, 95,000 Zinzaras, and 40,000 Spanish Jews. The remainder consists of gypsies and foreigners. It may be added that the number of Albanians and Turks is probably taken too high; that of the Servians, on the contrary, too low."

— An expedition, under Dr. Bunge and Baron von Toll is to start next spring for the exploration of the New Siberian Islands, which, since Anjou's journeys in 1821–23, have only been visited by the ill-fated members of the Jeannette expedition, on their way to the mouth of the Lena.

— A French journal has recently called attention to the following good case of 'mental suggestion:' On July 14, 1884, Mlle. A. E. was put into the hypnotic condition by a friend who tells the story, and who says to her, "On Jan. 1, 1885, at 10 A.M., you will see me; I will come to wish you a happy new year; after this I will immediately disappear." Neither spoke of this until after Jan. 1. On that day Mlle. A. E. was in Nancy, and the narrator in Paris. "At 10 o'clock she heard a knock at the door, and saw me enter, and heard me wish her a happy new year in a loud voice, and suddenly disappear. She went to the window to see me as I went out of the door into the street, but I was not to be seen. In telling the story to a friend, she expressed surprise at seeing me in a summer suit of clothing at that time of the year. Of course, it was the suit I wore on July 14. In spite of my affirmations, she insists that I was really with her on New year's day."

— Reporting on the trade of Tamsui, China, the English commissioner of customs says that the trade in camphor is represented in the returns by such an insignificant figure that there is great

fear of its total extinction in the near future. The immediate cause of its rapid collapse may be traced to the eagerness of the Chinese to acquire by all possible means as much territory as possible. During the last three years hills thickly wooded with camphor trees have been burned over by the Chinese, in order to compel the savages to withdraw. Destruction on so large a scale, naturally tells on the camphor trade. Forests of camphor trees do still exist farther inland, but the absence of all beaten tracks across the mountains renders them difficult of access.

— M. Parize, director of the agricultural station of North Finistère, in Spain, reports a curious phenomenon resulting from the explosion of a tempered glass crucible. He heard one day a violent explosion in his laboratory, and, hastening into the room, saw on the table and floor, in a circle, a layer of glassy *débris* resembling crystals of sulphate of soda. The explosion was caused neither by a blow nor disturbance of the air. The grains varied in size from the head of a pin to a pea, with a few as large as a nut, but these were divided by cracks which would break them into analogous grains. An inkstand of pressed glass exploded in a similar manner not long ago in Boston.

— The small volume just published by Prof. Rudolph Eucken of Halle, entitled 'Prolegomena zu forschungen über der einheit des geisteslebens,' and which is published as the methodological part of a forthcoming comprehensive work on the subject, is as remarkable a bit of philosophical word-mongering as we have lately seen. The author is an expert in terminology, and in this thick pamphlet advances from the history of terms to the invention of them. Instead of psychological he proposes the term 'noological' as more comprehensive because including spirit. Instead of system, the word 'syntagma' is introduced to include large collective tendencies and unities of action as well as of thought. 'Innensicht,' 'vollthat,' 'arbeitswelt,' 'kombinierendes thun,' which are hardly translatable, and many far more familiar words, are given a precise and technical not to say strained meaning, as instruments to help the author in the impending self-delivery of his system. His problem is stated in so manifold ways—is so hard for him to state in fact—that its solution must be difficult indeed. It is, in general, whether there is a unitary character to mental life and the world; whether one force animates all the fulness of being; or, again, whether the universe is one collective act, or fact, with any character so distinctive that it may be described. The texture and quality of the thought is thin and poor. There is no index to speak of, no *résumé*, and little promise of reward to the diligent reader.

— Aug. Boltz concludes, in a pamphlet on 'The Cyclops, an historical people, deduced from language,' that Cyclops is a perverted form of Siclos, or Siculos, the name of an Italo-Pelasgic tribe inhabiting the eastern portions of Sicily; and that it has no proper etymological connection with the words κίκλος and ὄψ. Nevertheless, he thinks that the mythological one-eyed giant of Homer may have originated from some instance of natural monstrosity in real life, that had been encountered by the first Greeks who visited the island.

— In a paper read before the Anthropological institute of Great Britain, Sir J. Park Harrison has stated that, according to his observations, among the English the great toe is longer than the second; but as the ancients have represented in statuary the second toe as the longer, this must have arisen from a different proportion prevailing in Greece and Italy. Barroil finds (*Arch. per l'antrop.*, vol. xv.), however, as the result of 447 measurements of Italians, that 62 per cent have the great toe longer; and although it is true that, of twelve antique statues in the galleries of Florence, all but two have the second toe longer, he thinks this has arisen from a conventional feeling, which regarded that shape of the foot as more beautiful. It is found to be the case frequently that the relative length varies in the two feet. While the great toe is the longer in the majority of mankind, the case seems to be reversed in the mongoloid and negro races.

— The Russian government has summoned the principal ironmasters and manufacturers of the Ural and middle Russian districts to attend a conference at St. Petersburg, at which delegates of the various industries will be present, in order to discuss the steps that should be taken to improve the iron industry of Russia. Since 1874 the production of pig iron has not increased, and in some years has decreased. Instead of being, as Russia once was, one of the leading iron-producing countries, Austria produces twice as much, France nearly four times, Germany five times, and England, once an importer of Russian iron, now produces ten times as much. The Moscow *Gazette* ascribes this to an antiquated system of commerce, onerous railway rates, and insufficient protection on the part of the tariff.

— A large falling-off in the immigration is reported by the chief of the bureau of statistics. The number arrived during the year was 395,[illegible] against 518,592 during the preceding falling-off of fifty per cent [illegible] arrivals were 788,902.

WASHINGTON LETTER.

THE department of agriculture is showing a renewed interest in the sorghum and sugar industries of the country. Professor Wiley, the chemist of the department, has sailed for Europe, where he will spend as much time as is necessary in the investigation of the present condition of these industries in various countries, and a study of the latest improvements in machinery and methods. The results likely to arise out of Professor Wiley's visit will doubtless be of considerable importance as enabling the department to contribute to the success of the experiments that are being made in the United States.

Much interest is just now exhibited in scientific circles in experimental seismology. The rooms of the Philosophical society were crowded at its last meeting, the principal topic being the discussion of the observations made at the time of the Flood Rock explosion. Although perplexing, and to some extent inconsistent, the results promise to be of considerable value. Captain Dutton, in whose hands this subject is placed by the director of the geological survey, proposes to take advantage of dynamite explosions, which are frequently occurring in the excavation of a tunnel near the city, to continue the investigation of the question of the velocity of transmission of the disturbance, and it is earnestly desired that he may be allowed all needed facilities.

It is reported that Baba Gopal Vinayak Joshee, a Brahman pundit, and fellow of the Theosophical society of Bombay, is the guest of Dr. Elliott Coues of this city. An enterprising reporter for one of the city papers has interviewed both the distinguished theosophist and his host, no less distinguished in that line, and, if they are correctly reported, has been made the medium for the transmission of information of the most vital importance to an expectant and anxious public.

All the 'working processes' of this wonderful philosophy were concealed from the newspaper man, however, and for two reasons, which, in his calmer moments, he cannot but regard as somewhat personal. One was that "this knowledge in the hands of bad men would be a terrible thing;" the other, that "a mind not yet cultivated to follow out this high train of thought might be driven insane by it."

A good deal was said about 'astral visits' and that sort of thing, and experiments and results were recounted, in comparison with which the work of the Society for psychical research, with its cards and its guessed numbers, appears absolutely childish; in fact, it must be relegated to the

Preparations are being made for the meeting of the American public health association, to be held in this city early in next month (Dec. 8–11). A strong local committee has been appointed, including, among others, several leading physicians of the army and navy. The meeting is likely to bring together a large number of the leading sanitarians of the country. The association is but little more than ten years old, but it is one of the most active and influential in the world. Z.

Washington, D.C., Nov. 16.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The swindling geologist.

PROFESSOR SALISBURY'S letter in *Science* for Nov. 6 gives the present location of a miscreant who has been plundering cabinets and libraries throughout the country for the last two or three years, and who has been making decent people even more unhappy by assuming their names than by stealing their books. His present address is County Jail, Elkhorn, Wis. *Esto perpetua.* This is the address; but as to the name, who knows? For the last six months he has dragged through the mire the honored name of Leo Lesquereux, to the great annoyance of the venerable owner. Before this he was Prof. F. A. Arendel of the Pennsylvania survey. Other names under which he has stolen and swindled are N. U. Taggart, E. Douglass, E. D. Whitney, E. D. Strong, etc. Three of these names have the initials E. D., in which fact there may be some significance.

The Milwaukee police record says of him that he has but one hand, wearing a false hand on one arm. This fact may help to identify him. He seems to have a remarkable amount of geological knowledge, and especially on fossil botany. Where did he get this knowledge? Who trained him? Who was his father? Who was his mother? Has he a sister? Has he a brother?

These are questions that many victims desire to have answered, in whole or in part. E. O.

Columbus, O., Nov. 9.

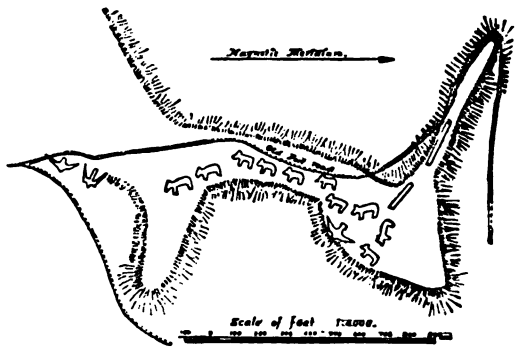
Effigy mounds in Iowa.

Near the village of North McGregor, Clayton county, Iowa, on the south-western quarter of section 3, T. 95, R. 3 W., is situated probably the largest group of 'effigy' or imitative mounds west of the Mississippi. These earthworks are built on a dividing ridge, and are elevated about 500 feet above the river. The surrounding country is broken and rugged, the bluff on the east side along the Mississippi River being perpendicular in many places. To the north-west lies Yellow River, and on the south-west Bloody Run. This remarkably fine group was surveyed by me on the 25th and 26th of May, 1885; and a few details, illustrated by a topographical plan, may perhaps be acceptable to those readers of *Science* who are interested in North American antiquities.

These mounds number fifteen in all, consisting of two long embankments, ten animals, and three birds, and they occupy a *terre-plein* of just about 2,000 feet in length. The first embankment is 190 feet long, 18

feet wide, and 1½ feet high; the second, 138 feet long, 18 feet wide, and 1½ feet high.

The animals represented vary from 79 to 109 feet in length, and are from two to three feet in height. No two are exactly alike in outline, though the difference is more in the shape of the head than in the general form. It will be noticed that they are all tailless, though, of the whole number of beasts surveyed by me to the present time, fully two-thirds have tails. Considered as works of construction,



they being in relief, these animals are very fine; but, taking the size and shape of the legs and head in proportion to the body, they are decidedly clumsy. Indeed, with a few exceptions, the animal-shaped mounds of western Wisconsin, also, are no exception to this rule. It is probable that each leg, as built, was intended to represent a pair of legs rather than a single one, and this may account for their clumsiness.

The birds of this group are each different in form, and are more symmetrical than the animals, which is usually the case. Though symmetrical, the wings of bird effigies are nearly always much longer than they should be in proportion to the length of the body and head as compared with natural birds.

An ornithological friend (Dr. Thomas. S. Roberts of Minneapolis) has furnished me a list showing the actual length — from point of bill to the end of longest tail-feather — and breadth, from tip to tip of wings, fully outstretched, of some forty-six North American birds. Taking this length as the unit, I find the proportions of four of them to be as follows; viz,—

Of the Magpie (the lowest).....	1 : 1.28
" Wild turkey.....	1 : 1.29
" Bald eagle.....	1 : 2.365
" Fish-hawk (the highest)	1 : 2.80

Now, on examining the diagrams of forty-three undoubted bird-effigies surveyed by myself, it appears that fifteen are over the extreme natural limit given above — the ratio of one of them being as high as 1 : 7.20, and that of the very lowest not less than 1 : 1.50. The actual size of this longest 'bird' is, length of body, 77 feet; and from tip to tip of wings, 554 feet.

It will thus be seen that to classify these earthen imitations of birds according to any natural system is almost an impossibility, and, with a few exceptions, it is the same with the effigies of animals, reptiles, etc. An instance may be given of one near Viola, Wisconsin, which looks more like a deer than any other animal. Its head is turned as if looking over its back, but the tail spoils the whole effect, on that supposition; it being 140 feet in length, nearly twice the length of the body (74 feet).

There are effigies undoubtedly representing turtles and lizards; there is also a class to which either name can be applied. The question is, To which category do they belong?

In view of all these facts, therefore, it would appear that attempts to speculate about the object or uses for which these fantastic earthworks were constructed, or concerning the precise kind of animal, etc., represented by the effigies, might be considered, in the present state of our knowledge of the subject, a little premature. As matters of fact, however, it may be stated that an examination of some hundreds of these mounds justifies the drawing of two conclusions, first, that the creatures point or head, with a very few exceptions, in a southerly direction; second, that when situated near a stream the feet of the quadrupeds are towards the water.

At intervals, between Guttenberg and Yellow River, there are mounds and embankments which occur either singly or in groups, but there are only two other points in that stretch where effigies occur. About one mile south and east of the group described in this article there is a single bird-effigy. Near Sny McGill, about three miles above Clayton, there is a group of 92 mounds; two of them represent animals, and two birds; the remainder are round mounds and embankments. While I was surveying this group, Mr. Frank Hodges of Clayton opened one of the larger tumuli, and found a number of skeletons in it.

T. H. Lewis.

St. Paul, Minn., Nov. 2.

Coleoptera of America.

The note in *Science* (vi., 382) conveys a very erroneous idea as to the result of recent studies upon the number of species of North American beetles.

The number given in Austin's supplement is 9,735 (not 9,704, as stated in *Science*); but as the supplement was to be used in connection with Crotch's list, it was numbered continuously wtih it, and no allowance was made for the reduction and duplication of numbers. Taking these into consideration, the supplement contains but little over 8,850 species.

The list just issued by the American entomological society contains over 260 unnumbered names which should be added to the 9,238 when this list is compared with previous ones. Recent studies have increased, not reduced, the number of species of North American beetles.

Samuel Henshaw.

Boston, Nov. 7.

Marsh's Dinocerata.

In my review of Professor Marsh's work on the Dinocerata occurs a blunder for which I wish to apologize (*Science*, June 12, 1885, p. 489). This error is as follows: "In the figure of Dinoceras, however, the humerus is incorrectly drawn (compare plate 28, fig. 2)." The figure here referred to is the humerus from the *inside*, that in the restoration is of course seen from the outside, and the two are in no sense comparable. I cannot explain how such an oversight came to be made, but now that my attention has been called to it, it is only proper to make the correction. This is, however, a very non-essential matter of criticism, which in other respects does not modify.

SCIENCE.—SUPPLEMENT.

FRIDAY, NOVEMBER 20, 1885.

RECENT LAND LEGISLATION IN ENGLAND.

THE attitude of the English government toward the land question has undergone a thorough revolution within the last generation. Thirty years ago all propositions to reform the abuses which had grown up under the present system of land laws were uniformly met by loud protests about the sacredness of vested interests, the 'naturalness' of the existing order, and the danger to society and the government of disturbing it in any way whatever. It was insisted that it would be a violation of all sound principles of political economy for the government to go beyond its province so far as to interfere with the relation of landlord and tenant, or that of tenant and laborer, or that existing between these classes as a whole and the public. So vigorous was this protest, and so in accordance with the prevailing views as to the true sphere of government interference, that reformers were usually content to withdraw their propositions.

But this attempt to delay or prevent much-needed reforms in governmental policy was destined to bring with it the usual penalty. The disease, which might have been modified, if not entirely cured, by mild remedies rightly applied at an early stage, became more and more deep-seated and serious with every passing year. The movement for reform, too long delayed, and gathering force with every rebuff, has finally proved irresistible, and in its onward sweep has carried the government and the people far beyond what would have been necessary if legitimate demands had been satisfied in the first place.

The evidence of this is seen very plainly in the changed attitude and policy of the government, which has recently given most unmistakable evidence of its determination to take up the question in earnest, and to leave no stone unturned in order to secure a permanent settlement. In this endeavor, limited thus far chiefly to one phase of the Irish land question, it does not propose to be checked by any theoretical considerations as to true limits of government interference. It ·dy to do any thing which promises to ient or even temporary relief. If ·ill declare martial law. It will confiscate landed estates by the wholesale. It will change a tenant at the will of the landlord into a tenant at his own will. It will convert a tenant into a proprietor. It will lend money, to those wishing to buy land, at low rates of interest and on insufficient security. It will destroy all freedom of contract in regard to the use of land. It has, indeed, already done all these things.

The proof of these statements is to be found in the history of recent acts of parliament on the land question.[1] It is impossible to convey a clear idea of such a complicated problem as the Irish land question in a brief space, but one or two of the most important points may be set forth which will illustrate the far-reaching sweep of recent legislation.

The act which really introduced the new policy was that of 1870, which declared whole classes of contracts hitherto in vogue between landlord and tenant to be void both in law and equity, and established the novel principle of compensation for disturbance or damages for eviction. It took from the landlord the right to dismiss a tenant so long as he paid his rent. It secured to the latter a just compensation for all improvements, whether made with or without the consent of the landlord, and conferred on him the power to sell his tenant-right, with all the privileges pertaining thereto. This act was in form, therefore, a great encroachment on the control of the landlord over his property. But as it did not regulate the amount of rent which the latter might exact, it left him, after all, in practical control of his property, since he might raise the rent at will, and evict the tenant if he did not choose to pay it. It rather aggravated than lessened the difficulty.

The act of 1881, which was the most important act relating to Ireland, was the logical outcome of the act of 1870. It finished the work which the latter had begun by establishing a series of optional courts for regulating rents. They are optional in the sense that either landlord or tenant may resort to them in case he is not contented with the terms of a lease. The court, in case of a resort to it, fixes the rent which the landlord may exact. When the rent is thus judicially fixed, it is to hold good for a period of fifteen years, when, by a similar process, it may be modified to suit altered circumstances during another period of like duration. As long as the tenant pays the rent

[1] *Economic aspect of recent legislation.* By WILLIAM WATT. London, *Longmans, Green, & Co.*, 1885.

thus fixed, he cannot be disturbed in possession by the landlord, except on the payment of a fine known as 'compensation for disturbance.' The tenant may sell his tenant-right to another, who has then all the privileges as against the landlord which the original tenant enjoyed. In this way are secured the three 'F's,' — Fair rents, Fixity of tenure, and Free sale. In this way, also, the landlord is almost completely deprived of any real control of his property.

The act has not been, by any means, a dead letter. Eighty-five sub-commissioners were, in 1883, engaged in the work of determining 'fair rents,' and the number was afterwards somewhat increased. As a result a general reduction in rent was effected, amounting on the average to about twenty per cent, and in some cases to thirty per cent and upwards. This virtually amounts to a confiscation of from one-fifth to one-third of the capitalized value of landed estates in Ireland. Its moral effect may lead to a still further reduction in value: for who can be sure that a government which has confiscated one-fifth of the estate will not subsequently confiscate it all if peace and quiet shall not follow as a result of the present measure?

Both acts above mentioned contained provisions intended to favor the growth of a class of peasant proprietors. The purchase of holdings by tenants in the case of estates which fell under the jurisdiction of the encumbered estates court, was favored by the authority given to the Irish board of works, in 1870, to advance two-thirds (increased in 1881 to three-fourths) of the purchase-money at three and a half per cent interest, to be repaid at intervals during a period of thirty-five years. It has already been proposed to extend this authority so as to let them advance all the purchase-money at a lower rate of interest, for a longer time.

He would be a bold man indeed who would assert that these acts, sweeping as they are, constitute any real contribution to the actual solution of the Irish problem. Such a statement could only be made by one who had a political point to gain, or who had given but little attention to the actual investigation, even at second hand, of the social and economic conditions which prevail over a large part of Ireland. The difficulty lies deeper than any mere landlordism, and it will not be long until the Irish land question will be again to the front, and that, too, whether Ireland be under English or Irish rule.

These acts, however, mark a new era in English legislation on this subject. They indicate (and herein lies the hopeful feature of the case) that the English people are now ready to take up this and similar questions in earnest. They are now willing to throw to the winds all doctrinaire theorems of *laissez-faireism*, to disregard alarmist speeches about approaching communism or socialism, and to close their ears to the old song about the supreme sacredness of private property. They are now determined, after getting all the light they possibly can from economic and historical science, to make use of the only means which promises any solution whatever, viz., that of actual experimentation. The outcome of the recent experiments in Ireland, to which the late acts have been practically limited, will afford great assistance in the solution of the Scottish and English land questions, which must soon come to the front.

E. J. James.

THE BLACKFOOT TRIBES.

At the late meeting of the British association for the advancement of science, a committee of the anthropological section presented a report (prepared by Mr. Horatio Hale) on the tribes of the noted Blackfoot confederacy. The report comprises many particulars relating to the origin and history of the tribes, the character of the people, their mythology, languages, and mode of government, and their present condition. The facts have been mostly derived from correspondence with missionaries now residing among the people, and from official documents, with some memoranda made by the author of the report during an exploring tour in Oregon. Only a brief abstract of the information thus brought together can here be given.

The tribes composing the confederacy are, or rather were, five in number. Three of these, forming the nucleus of the whole body, are the original Blackfoot tribes, who speak the same language, and regard themselves as descended from three brothers. These are the Siksika, or Blackfeet proper; the Kena, or Blood Indians; and the Piekané, or Piegans (pronounced Peegans), — a name which is sometimes corrupted to 'Pagan Indians.' To these were added, when the confederacy was at the height of its power, two other tribes, — the Sarcees, who joined them from the north; and the Atsinas, who came under their protection from the south. The Sarcees are a branch of the great Athabascan or Tinneh family, which is spread over the northern portion of the continent, in contact with the Eskimo. The Atsinas, otherwise known as Fall Indians and Gros Ventres, are shown by their language to be akin to the Arapohoes, who once wandered over the Missouri plains, but are now settled on a reservation in the Indian Territory.

The dividing line between the United States

Canada has cut the confederacy in two. Most of the Piegans, with the few surviving Atsinas, reside on the American side, where a large reservation has been set apart for them, along the head waters of the Missouri River. The residue of the Piegans, with the Siksika, Kena, and Sarcee bands, dwell on reserves laid off for them near the southern boundary of the Canadian northwest territories, adjacent to the Rocky Mountains. Thus the lands occupied by these tribes, though much diminished in extent, are in the same region which they held fifty years ago, when their confederacy was the dominant power among all the Indians west of the Mississippi. At that period their numbers were reckoned at thirty thousand souls. Various causes, but more especially the ravages of the small-pox, have greatly reduced them. The population of the four Canadian reserves is computed at about 6,500, divided as follows: Blackfeet (Siksika), 2,400; Bloods (Kena), 2,800; Piegans (Piekanė), 800; Sarcees, 500. On the American reservation there are stated to be about 2,300, mostly Piegans, with some Sarcees. This would bring up the total number of Indians in these tribes to nearly 9,000 souls.

The country inhabited by the Blackfeet was the favorite resort of the buffalo. The vast herds which roamed the plains, or found shelter during the winter in the woody recesses of the mountains, furnished the tribes not merely with food, but with the skins which made their tents and their clothing. The complete extermination of these animals, which has taken place during the last five years, has made an entire change in the mode of life of these Indians. From a race of wandering hunters, they have become a community of farmers, and, as the official reports show, have displayed a remarkable aptitude for the arts of civilized life. Under the direction of superintendents and farm instructors appointed by the Canadian government, they have erected comfortable log-houses, well furnished with cooking-stoves, table-ware, and other household appliances, and have raised large quantities of potatoes, barley, oats, turnips, and other esculents. They have shown themselves always orderly and prudent in their dealings with the government and the white settlers.

The Blackfoot language was formerly supposed to be entirely different from any of the languages spoken by the surrounding tribes. This was the report of the first explorers. Further investigations have shown that this opinion was not well founded. The language proves to be Algonkin in its grammar, but to be in a large part of its vocabulary widely different from other Algonki tongues. It is evidently a mixed languag kind which results from the conquest of one tribe or nation by another speaking a different tongue. What is known of the history of the Blackfeet shows how this conquest and intermixture may have taken place. The Blackfoot tribes formerly inhabited the Red River country, from which, as there is good reason to believe, they were driven westward by the Crees, who formerly dwelt in Labrador and about Hudson Bay, but who now occupy the ancient homes of the Blackfeet along the Red River and the Saskatchewan. The Blackfeet, when they retreated to their final refuge in the valleys and plains along the eastern slope of the Rocky Mountains, had in their turn to overcome and absorb the population which they found there. The traditions of the people, and other circumstances, seem to show that the tribe thus conquered — and whose language probably furnished the foreign portion of the Blackfoot vocabulary — had come from the west or Oregon side of the mountains.

In further confirmation of this view, it is shown that the Blackfeet have not only a mixed language, but also a mixed religion. While their legendary cosmogony and their principal deities are purely Algonkin, their chief religious ceremony, the famous sun-dance, to which they are fanatically devoted, — the most extraordinary trial of faith and of endurance known among the western Indians, — is clearly of exotic origin. It is wholly unknown to the other Algonkin tribes, except to a few Crees, who have apparently learned it from the Blackfeet. It also prevails among the Dakotas, but chiefly in the western bands nearest to the mountains and to the Blackfeet.

The form of government among the Blackfoot tribes, as among the Algonkin tribes in general, is very simple. Each tribe has a head chief, and each of the bands composing a tribe has its subordinate chief; but the authority of these chiefs is little more than nominal. Their prerogatives are chiefly those of directing the movements of a camp, of presiding in council, and of representing the tribe or band in conferences with other communities. The term 'confederacy,' applied to the union of the Blackfoot tribes, is somewhat misleading. They have no proper inter-tribal league, like that of the Iroquois nations. There is simply a good understanding among them, arising partly from the bond of kinship, and partly from a sense of mutual dependence. Even the three proper Blackfoot tribes can hardly be said to have a general name for their whole community, though they sometimes speak of themselves as *Sawketakix*, or 'men of the plains,' and as *Netsepoyè*, or 'people who speak

The foregoing, as has been stated, is only a brief summary of the contents of this report, which is given in an abridged form in *Nature*, and will doubtless hereafter be published in full by the association. The facts which it presents disclose in the people of this aboriginal Switzerland qualities much above the average, and should lead to further inquiry into their history and characteristics.

SOME REACTION-TIME STUDIES.

THE study of reaction times derives a great interest and importance from the fact that by this means another bond of relation between mind and matter becomes apparent. All material actions require time. Mental actions as well, from the perception of a sensation to the highest expression of the intellect that offers itself to experimental investigation, also occupy an appreciable amount of time. This mental time is not constant as the time of a falling body in space, but is affected by slight variations in bodily and mental conditions.

M. Beaunis[1] has studied the effect of one important mental requisite, namely, expectation. The reactions were made to a visual sensation, and 36 persons besides himself (most of whom were medical students) were experimented upon. A signal (*advertisement*) was given, whereupon the subject held himself in readiness for the flash of light, so as to react by pressing the key as quickly as possible. The time between the signal and the flash of light is the *expectation time;* that between the light and the seeing of it, the *reaction time.* The expectation time was varied from .3 sec. to 3 sec., and the following conclusions were reached: —

(1) As others had already shown, the reaction time is shorter if a signal is given than if it is not.

(2) The *longer* the expectation time, the *shorter* the reaction time. The experiment may be compared to the problem of finding an object in a dark room by bringing the light of a bull's-eye lantern upon it. When there is no signal, that is, when directed to find the object without time to get the lantern ready, it would evidently take longer to find the object than it would if time were given to get the lantern in position; and the longer this time, the quicker would the object be found. The attention acts as the bull's-eye lantern.

(3) The difference between the minimum and maximum times is greater than when a signal is not given, and increases as the expectation time increases.

(4) The influence of several individual differences, etc., was evident. In two of the medical students the reactions were always slow. In many it was very quick. M. Beaunis was the only person who was accustomed to this kind of experimentation, and in his case a much smaller percentage of experiments had to be thrown out as faulty than in the others. The effect of health was marked in one case. Feeling slightly indisposed in the morning, M. Beaunis's reaction time was .37 sec., *i.e.*, abnormally slow. In the afternoon it was .222 sec., showing that the normal condition was returning. Two hours later it was normal (.160 sec.).

An extremely interesting research is that of Guiccordi and Ranzi,[1] in which they compare the reaction time to a sound impression in normal persons with the same in patients suffering from auditory hallucinations. The reaction time is obtained somewhat in this way. The making of the sound which serves as the stimulus sets into motion a chronoscope, which the subject stops, as soon as the sound is heard, by pressing an electric key. In this way the following table, giving in seconds the time necessary for hearing the sound, was prepared: —

	Normal.	Hallucinated.
Average of 10 shortest reactions out of 50	.1012	.0947
Average variation	.0033	.0046
Average of remaining 40 reactions	.1259	.1408
Average variation	.0132	.0206
Average of all 50 reactions	.1135	.1175
Minimum time	.0885	.0802
Maximum time	.1731	.2287

Taking the mean of the 10 shortest reactions, or comparing the minimum reaction time, we see that those suffering from hallucination are quicker in their perception of sound; and this difference must be ascribed to morbid irritability of these centres of apperception. On the other hand, the other averages, and especially the average divergence from the mean reaction time, *i.e.*, the average variation, and the maximum time, show that normal persons can command a steadiness and regularity of the attention, which is impossible in those afflicted with sound hallucinations.

In many cases the reaction time is and must be studied under rather artificial conditions. This circumstance is apt to weaken inferences drawn from such studies to similar processes in normal mental activity. In a recent study[2] of the time necessary for recognizing letters, numbers, colors, etc., this difficulty has been successfully overcome. Small letters were fastened to a revolving drum, and looked at through a slit of variable width in a screen held before the letters. The letters ap-

[1] *Revue philosophique*, September, 1885.

[1] *Revue philosophique*, September, 1885.

[2] "Ueber die zeit der erkenn schriftzeichen, bildern und f losophische studien (Wundt). The work was done in th Johns Hopkins university.

adjusted at such distances that, with a slit 1 cm. wide, one letter is always in sight; if 2 cm. wide, two letters; and so on. By varying the rate of rotation of the drum and the width of the slit, the time necessary for the reading of a single letter under various circumstances was obtained. Up to a certain limit, this time is *shortened* as the slit is *widened*. This fact is to be interpreted as follows: In reading these letters, two time elements are involved: 1°, that of recognizing the letter; and, 2°, that of naming it. The association between the sight of the letter and its name is so close, that the latter action is performed automatically: hence, if the letters follow one another with so great a rapidity that the first can be named while the second is being recognized, the average time for reading a single letter will evidently be shortened; and the experiments show that this power of carrying over one letter while pronouncing the preceding can be active when three, or in the case of several persons when four or five, letters were present to the eye at once.

Another series of experiments showed that it takes longer to count letters than to name them; and if the letters are counted in groups of two, or better still of three, instead of singly, the counting time is reduced.

The time necessary for reading words in different languages was also studied; and the general result is, that the maximum rapidity with which words forming sentences can be read varies directly with one's acquaintance with the language. A German read 100 German words in 18.4 sec., but 100 English words in 29.1 sec. This method offers a means of objectively testing a person's acquaintance with a foreign language. If the words are read backwards (thus eliminating the sense of the passage, and reducing the process to mere reading), the time is lengthened; but the smaller one's acquaintance with the language, the less difference in time between reading it forwards and backwards.

It seems that among those tested, women read faster than men; and Germans take longer to spell their words than English-speaking persons.

If small strips of colors are used, instead of letters, it takes almost twice as long to name the true color as it would to name a letter; and this difference in time is due to the greater difficulty in finding the proper name. In this case the association between the color and its name is a loose one. These studies will be continued in the next number of the *Studien*. J. J.

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THE LAWS OF TEMPERATURE IN THE AUSTRIAN ALPS.

DR. JULIUS HANN of Vienna, editor of the Austrian meteorological journal and a leader among European meteorologists, has lately completed his detailed studies on 'Die temperaturverhältnisse der oesterreichischen alpenländer,' which are now published in three parts in the *Sitzungsberichte* of the Vienna academy of sciences. All available observations are included in the reductions, and the results are stated with great detail. As to method, attention should be emphatically called to the reduction to normal means; that is, to the mean of some definite series of years, in this case the thirty years from 1851 to 1880: thus, if a station had records from 1855 to 1884, the mean of these thirty years' observations was reduced to what it most probably would be for 1851–1880 by the use of a correction determined from neighboring stations where the records covered both periods; that is, from 1850 to 1884. Wild of Russia, and Buchan of Scotland, have employed this method for low-level stations; Hann is the first to show its applicability to mountain stations also. As to results, one of the most striking is the appearance of the *increase* of temperature upwards in the thirty years' winter mean of valley and mountain stations as a persistent climatic element. Observations of late years have shown that this inversion of temperature — extreme cold in valleys with moderate cold on mountains — was common enough in the winter during anticyclonic or high-pressure weather, but it is here first shown to be a persistent inversion characteristic of the winter mean. Hann was also the first to explain, several years ago, the peculiarities of the warm winter alpine wind known as the *föhn*, which depends directly on the unduly high temperature of the upper air in winter.

BEN NEVIS METEOROLOGICAL OBSERVATORY.

THE highest of the Scotch mountains, Ben Nevis, reaches an altitude of four thousand four hundred feet; less than five miles away, the sea stretches a long arm up the submerged portion of the great glen to Fort William. On this well-chosen summit, in the path of many a storm from the Atlantic, the Scottish meteorological society has built an observatory, here figured, for the direct study of the conditions of the upper air, which observations at their low-lying stations must leave to inference. Most of the few mountain observatories of Europe stand at a greater height than the summit of the Ben, but none of

them have the peculiarity of being immediately by the sea, and none are so frequently visited by storms. Hourly observations of the usual meteorological elements are taken by Mr. Omond, the superintendent, and his two assistants; and, if the observatory be maintained as well as it has been begun, its records must yield results of the greatest value in the study of the weather. Unfortunately, its support still depends only on general subscription. Among the generalizations thus far made for Ben Nevis by Mr. Buchan, secretary of the Scottish society, we may quote the following: are prevailingly cold, on account of the rapid loss of heat by radiation from the ground through the clear, dry air. Mountains, therefore, have a meteorology of their own, and one that is well worth studying.

BEN NEVIS METEOROLOGICAL OBSERVATORY. (*London graphic.*)

The mean velocity of the wind is greater at night than at day, this being the reverse of the variation found at low-level stations, but in accordance with the results of other mountain observatories and with theoretical deductions; diurnal variations of temperature are small, the change from warm to cold weather being very largely dependent on the passage of cyclonic storms; the temperature is abnormally high during the passage of an anticyclone, or area of high atmospheric pressure, in which the air descends from great altitudes, and is warmed by compression; this, like the variation of the wind, being the reverse of what obtains at lower levels, where anticyclones

THE ORIGIN OF MEDIAEVAL UNIVERSITIES.

An important contribution to the history of higher education has been made in Germany by the publication of a work[1] on 'The mediaeval universities prior to 1400.' Its author is *unterarchivar* of the papal see, P. Heinrich Denifle, and he has brought the thorough methods of research which are characteristic of the Germans to the discussion of the ample stores of information which are to be found in the archives of Rome, Florence, Paris, Leipzig, Munich, Erlangen, and other ancient seats of learning. The volume before us includes more than eight hundred pages, but it is only one-third of the proposed work. It discusses the origin of the universities in the middle ages; and their organization and constitution are to be considered

[1] *Die universitäten des mittelalters bis* 1400. Von P. Heinrich Denifle. Band I. Berlin, [illegible]. 1885.

in the second part, and in the third many subordinate subjects. Our space will not allow us to do justice to the erudition of this great work, but we can, perhaps, exhibit its scope so that those who are interested in the circumstances which gave birth to the progenitors of our modern institutions may understand how rich a storehouse of learning has been provided for them.

The writer begins with the study of the now venerable words, *studium generale* and *universitas*. Both terms were in vogue as early as 1300. The former phrase has not been found in use as the name of a high school prior to 1233–34, when it is applied to the school of Vercelli: the phrase *studium universale* is a little older. *Universitas* (as other writers, following Du Cange or the lexicographers, have pointed out) had originally no special reference to a seat of learning. It signified very nearly what we call a corporation, and was almost synonymous with such words as *societas, collegium, corpus, communio, consortium*. Gradually it came to be employed for the corporation devoted to the pursuit of knowledge, and then was restricted to this use, so that *universitas oxoniensis* was interchangeable with *studium oxoniense;* but the proper designation of a mediaeval high school was *studium generale*, or *studium* alone. As early as 1254, the word 'university' is used in Paris as equivalent to 'college.' The definition of Hugolinus is worth quoting: 'Universitas est plurium corporum collectio inter se distantium uno nomine specialiter eis deputato.'

From this preliminary inquiry, the writer proceeds to the history of the universities of Paris and Bologna, which, in his view, require more elaborate treatment than the other high schools, not only because of their extraordinary direct influence, but because their constitution is the key to that of many later foundations. The school at Salerno, older than the two just named, was quite subordinate in general influence. Savigny's theory that universities, by a sort of natural evolution, were developed around the chair of an illustrious teacher, is vigorously opposed by Denifle, who recognizes many factors as co-working in the origin of an enduring university. New methods of instruction, and privileges accorded by authority, seem to our author most potent influences; but even more important was the forming of corporations for the promotion of study, or, in other words, the introduction of combined or co-operative methods of instruction. The different
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and laws still recognized, even in the disjointed members of American universities, the author takes up, one by one, all the other European universities of the period he is considering. He makes four groups,—schools, improperly called universities; high schools without letters of authorization; high schools which were established by papal briefs; and high schools which received their privileges from papal and princely authority. Finally, the relation of universities to pre-existent schools is very fully discussed.

We have said enough to show that the writer is original, and to a considerable degree controversial. Whatever criticism his views may call forth, — and they are likely to be most closely scrutinized in Germany,— his diligence in the collection of facts, his comprehensive views, and his abundant references to original authorities, entitle him to the highest praise. There is good reason to think that he is right in claiming that the period he is discussing, instead of belonging to the age of darkness, is one of those epochs when the mind of man has received new impulses of unusual and persistent force.

THE WASHBURN OBSERVATORY.

THE third volume of the 'Publications of the Washburn observatory,' lately issued, gives the results of the work of 1884. About 1,800 observations were made with the Repsold meridian-circle upon the gesellschaft southern fundamental stars and the Leyden Cape of Good Hope refraction-stars. The instrumental constants are given for each observing day, and an investigation of the zenith-distance micrometer-screw and of the horizontal flexure of the instrument. In the cold winter weather of Wisconsin the micrometer-springs turned out too weak to pull the slides, and had to be replaced with stiffer ones. The probable error of a single declination is now reduced to $0''.4$, a great improvement over that noted in vol. ii.; and a correction of $+ 0''.30 \pm 0''.026$ to the constant of the 'Pulkowa refractions' seems to be called for by the observations of 1884 to suit the atmosphere over Madison. Professor Holden expresses his continued satisfaction with the Repsold meridian-circle, and appears to be making a very thorough study of it; and in this his example might well be followed with profit by some of our older established observatories. Two determinations of the latitude by Mr. G. C. Comstock are given, — one from Professor Holden's and his own observations with the zenith-telescope, the other from his own with the prime-vertical transit, using both reflected and direct observations; the declina-

tions in both cases being those of Auwers' system. They come out respectively —

$$+ 43^\circ\ 4'\ 36''.97 \pm 0''.07$$

and $36''.99 \pm 0''.06$,

remarkably accordant results. The fifth part of the volume is a 'Catalogue of 1,001 southern stars for 1850.0, from observations by Signor P. Tacchini, at Palermo, in the years 1867, 1868, 1869,' by Rev. Father Hagen, S.J., and Edward S. Holden. The original observations had never been reduced to mean place; but being good ones, and in a part of the sky where needed, we have here the anomaly of European work reduced and published in this country; and Father Hagen and Professor Holden are to be highly commended for making it available, while its comparison with Oeltzen's Argelander (south) and the Washington zones served to detect many errors in these catalogues. The sixth part gives the observations of 437 southern stars made with the Washington transit-circle, and also the position of the same stars (whenever occurring) from the catalogues of Yarnall, Gould's zones, and Stone, all the positions being reduced to 1850.0 by Father Hagen. This is the first opportunity for easy comparison on a large scale between these four systems of southern declinations, and the comparison develops the following important differences of north polar-distance: —

Yarnall	$= + 1''.12$ (from 220 stars)
Gould (Z.C.)	$= + 1''.96$ (" 215 ")
Stone	$= + 1''.00$ (" 238 ")

It is a rather unexpected anomaly to find the Cordoba zone-catalogue and Stone differing by nearly a second, but that the Washington transit-circle should be so much out will not probably occasion much surprise to any one.

The volume closes with a count of the *Durchmusterung* stars between -2° and $+ 18^\circ$, a determination of the constants of some of the other instruments, meteorological observations for 1884, a summary of the same as taken at Madison continuously from 1858 to 1884, and is throughout a highly creditable publication. In his new field at the Lick observatory, Professor Holden will have the satisfaction of having left behind a valuable monument in these three volumes.

ARTIFICIAL WINDS

A NEW apparatus has been constructed by M. Rouzaire, a priest of Panniers in France, and brought recently before the French academy of sciences. It gives rise to air currents similar to the great winds of the earth's atmosphere, and hence its name, the *anemogène*. As described in *Engineering*, the apparatus consists of a small artificial terrestrial globe put into rapid rotation in the surrounding air. In fact, it is a miniature of the earth, and by its rapid rotation it gives rise to air currents resembling the trade and other dominant winds of the world. These currents are shown by girouettes placed round the globe at small intervals, like the wind marks on the French marine charts. The apparatus reveals the following facts: The north-east and south-east trades are reproduced, and the equatorial zone of calms caused by their meeting. The gentle breezes from north and south, which disturb the equatorial calms, are also seen. So is the overthrowal of the north-east trade in the south-west monsoons in the gulfs of Oman and Bengal. An ascending current in the equatorial regions is shown, and a descending current near the Azores under the centre of maximum barometrical pressure of the North Atlantic; also a descending current is indicated between St. Helena and the meridional coast of Africa, under the centre of maximum barometric pressure of the South Atlantic. At the poles there is a current descending from the zenith. The south-east trade at the Canaries is represented, while at the same time a south wind blows at the summit of the Peak of Teneriffe. Ascending currents from the east and west over Central America combine with the upper returning current of the north-east trade, thus explaining how the ashes of the volcano of Conseguina, on Lake Nicaragua, were transported to Jamaica during the eruption of the 25th of February, 1835. Owing to the defects of construction, the *anémogène*, however, does not reproduce in a perfect fashion the variable winds between the tropic of Cancer and 50° N. lat., nor the corresponding winds between the tropic of Capricorn and 50° S. lat. In the same way the south-west and north-west winds of 50° N. and S. lat. are not very faithfully imitated.

EVERY student of biology knows of Huxley and Martin's 'Elementary text-book of biology.' Most teachers have either used the book, or been influenced by it in forming or modifying their laboratory courses. But the lack of illustrations, and brevity of the text, made the book to many almost useless. Mr. Howe's atlas (*Macmillan*) is intended to supplement the text-book in the first of these particulars. Its plates show the student exactly the points to which the text refers. It is a series of twenty-four large plates containing some five hundred figures. Each plate is accompanied by two or three pages of explanation, and the work closes with a few admirable practical directions and a bibliography. In anatomical accuracy the book is all that any one could reasonably desire. The figures, however, differ greatly in ch[illegible] finish.

SCIENCE.

FRIDAY, NOVEMBER 27, 1885.

COMMENT AND CRITICISM.

THE RECENT COMPLETION of the new crematory at Mount Olivet, near Brooklyn, has again revived the subject of 'cremation *versus* inhumation.' An article by Dr. Rohé of Baltimore, recently published, takes the ground that there is no necessity of any radical change in our method of burial. While we are inclined to agree with him in his conclusions, we must take exception to a number of his statements. He says that, although the impression is general that cemeteries have an unfavorable influence upon the health of those living in the vicinity, there is very little trustworthy evidence to that effect. There is, we think, abundant evidence that in times past great injury to health has been caused by the burying of the dead in great numbers within city walls. Within recent times, when cemeteries are, as a rule, removed from the abodes of men, and are maintained in a far more sanitary way than formerly, these injuries have been reduced to a minimum. The history of New York City gives us proof of this. What is now Washington Square was seventy years ago the potter's field: from it arose most sickening odors at times. Troops stationed near it were seized with diarrhoea and fever, from which they did not recover until removed to another place. Trinity church cemetery was always regarded by the late Dr. Elisha Harris as contributing to the spread of cholera during epidemics of that disease in New York. He says, "Trinity churchyard, New York, has been the centre of a very fatal prevalence of cholera whenever the disease has occurred as an epidemic near or within a quarter of a mile of it." Other instances, almost without number, might be quoted as tending to show the prejudicial effect which some cemeteries have had upon the public health.

Dr. Rohé further states that "the generally observed good health of workmen in cemeteries and knackeries contradicts the opinion that the gaseous emanations from decaying animal matter are necessarily dangerous to health." This argument is one which needs great caution in its handling. It is one which is applied to every pursuit in life when for any reason that pursuit is charged with being detrimental to health. Thus scavengers, factory hands, and even children brought up on swill-milk, are, by those whose interest it is to make the claim, always represented as being in typical health. Statistics are appealed to oftentimes to bear evidence to the fact that the mortality in such a business is very small, when, as a matter of fact, the occupation of the decedent is stated as 'clerk' or 'laborer,' and the particular line of his occupation does not appear. Dr. Wicker, in his 'Sepulture and its methods,' calls attention to the depreciation in health of those who spend much time in the dissecting-room, suffering also from derangements of the digestive organs and diarrhoea. He has also found that those engaged about knackeries suffer similarly. "They begin to emaciate and present a cadaverous appearance, slight wounds fester and become difficult to heal, and, upon the whole, they are a short-lived class." That there is some danger to be apprehended from the fouling of water in wells situated near cemeteries, is shown by the fact that sanitary authorities find it necessary to limit the distance within which wells may be dug. Dr. Rauch believed that the water-supply of Chicago was at one time affected by the proximity of an old cemetery to its source. This question, like all others, has two sides; and while there is at the present time no urgent reason why earth-burial should be abandoned, in this country at least, there are many reasons why cremation should not be discouraged. The sentiment in its favor is certainly growing, and many of its promoters are among the best thinkers of our day. We certainly believe that those who prefer incineration to inhumation should have every opportunity to gratify their wishes, and, if necessary, that they should be protected by legal enactment.

IN VOLUME XIX. of the new edition of the 'Encyclopaedia Britannica,' published during the present year, in the article 'Polar regions,' by Clements R. Markham, p. 326, we find the following paragraph on the geographical work of the Greely arctic expedition: "Lieutenant Lockwood made a journey along the north coast of Greenland, and reached

a small island in 83° 24′ [N. Lat.] and 44° .05′ [W. Gr.]. Dr. Pavy and another went a short distance beyond the winter quarters of the Alert, and a trip was made into the interior of Grinnell Land. *But all this region had been explored and exhaustively examined by the English expedition in* 1875–76." The italics are our own. Attention has recently been called to this statement by the author, Charles Lanman, of a little memorial volume on the life and arctic work of Lieut. James B. Lockwood.

It appears certainly most astonishing that a writer on geographical subjects, especially those relating to the arctic regions, should allow haste, international feeling, or any other impulse, to lead him to make a statement in an authoritative publication which is not only untrue, but unjust in the highest degree to an explorer who died of privation in the very field of his labors. No explanation seems possible. It has long been a matter of record that Lockwood's farthest was not only the highest latitude reached by civilized man, but more than one hundred geographical miles in a direct line beyond Beaumont's farthest, and that the English expedition neither mapped nor 'explored and exhaustively examined' that part of the Greenland coast, nor the interior of Grinnell Land westward from Lady Franklin Bay and Archer fiord. It would seem a duty for the publishers, in another volume of the encyclopaedia, to place on record some disclaimer of this falsification of history.

THE AMERICAN ECONOMIC ASSOCIATION, which was recently organized at Saratoga, is represented as obtaining hearty support and co-operation, not only from professional students in political economy, but also from business men, who take a wide interest in the financial and industrial questions of the day. Among its members there are already professors representing more than a score of colleges and universities in all parts of the country, several college presidents, lawyers, editors of some of the most influential journals in the country, and a large number of clergymen, among whom may be named Dr. Barrows and Newman Smythe, not to mention Dr. Gladden and Lyman Abbot, who are actively engaged in the council of the association. Leading manufacturers are interested in its success, one of whom employs several thousand working-people, and another has more than a thousand names on his pay-rolls. The spirit of this broad and diversified support is well expressed in a letter from Dr. Elisha Mulford, the author of 'The nation,' in which he remarks that "in the transitions of human thought none has been more significant than the humanization of political economy." Committees are being organized for investigation on the co-operative plan. Under the leadership of Dr. Henry C. Adams, of the university at Ann Arbor, the committee on municipal finance is engaged in the special consideration of productive city property. It is collecting information concerning the relations of American municipalities to corporate institutions, such as railways, telephone lines, gas and water works, in order to determine the nature of the franchises which have been so freely bestowed by our cities. It will seek to learn, for instance, in what way rates of lighting-companies are controlled, and if any attempt is made to raise revenues from such institutions. This strikingly resembles the system of Le Play, and is thoroughly scientific in method. By such means an immense amount of economic data can be collected and synthesized in the light of economic science.

THOSE WHO ARE ANXIOUS to draw attention to themselves as claiming possible consideration from other scientific men too frequently have recourse to the use of all the titles which by accident or otherwise may have fallen to them. This tendency appears to have increased somewhat of late years, and, so far as this country is concerned, is doubtless an importation from Europe. It is, nevertheless, a tendency which should be deprecated. Aside from the very bad taste which it usually reveals, the indiscriminate use of all the titles which a man may possess, argues, in the first instance, a weakness which is thereby confessed to his scientific *confrères*. That titles have a definite value when properly used cannot be denied, and their attachment to a name on a business-card or in official correspondence is quite allowable; but even then, unless in exceptional cases, they should be reduced to the lowest terms consistent with the object in view. On the other hand, for one to go beyond his college and university degrees, and append the initials of all the scientific societies of which he may have become a member, savors of the methods adopted by the sciolist to gain cheap reputation. The modesty which usually characterizes true merit always shrinks from an undue display of the rewards which may have fallen to it.

DR. ASA GRAY'S SEVENTY-FIFTH BIRTHDAY.

THE seventy-fifth anniversary of the birth of Dr. Asa Gray occurred on the 18th of November. At the suggestion of the editors of the *Botanical gazette*, many of the botanists of North America united in presenting to the foremost botanist of the country a token of love and esteem in the form of a silver vase.

This vase was presented on the morning of the 18th, without formality. It is about eleven inches high, and is appropriately decorated with those plants which are distinctively American, and which are most closely associated with Dr. Gray. The place of honor on one side is held by Grayia polygaloides, and on the other by Shortia galacifolia. Among others, Aster Bigelovii, Solidago serotina, Lilium Grayi, Centaurea Americana, Notholaena and Rudbeckia speciosa, are prominent. The workmanship is highly artistic, as well as remarkably accurate, and reflects credit upon the designers, Messrs. Bigelow, Kennard, & Co., of Boston.

The vase stands on a low ebony pedestal, which is surrounded by a silver hoop, bearing the inscription, —

1810 — November eighteenth — 1885.
ASA GRAY,
in token of the universal esteem
of American botanists.

The greetings, by card and letter, of the one hundred and eighty contributors, were presented on a plain but elegant silver tray. They contain the warmest expressions of esteem and gratitude.

In the afternoon Dr. and Mrs. Gray received, quite informally, many of their friends.

A NEW SYSTEM OF OYSTER-CULTURE.

THE hope that I might solve, or help to solve, the oyster-problem practically, has served to constantly encourage me for the five years that I have been working with that object in view. In the belief that what I now have to offer presents one of the only possible practical solutions of the oyster-question, I submit it to the oystermen of our country as a method by the help of which they may be enabled to rear an abundance of 'seed' upon areas which are positively and absolutely under individual, proprietary control. The first principles of the new method are given below, and it will be seen that they include or embrace all that it has been proposed to accomplish by the use of any other plans hitherto proposed; that is, it is proposed to utilize the three dimensions of a body of water, moved automatically back and forth in a canal by the tides, for the purpose of spat-collecting. In such a canal an enormous amount of cultch or collecting surface will be exposed to the fry, diffused throughout the three dimensions of the surrounding water, during the spawning season. In this way the maximum amount of spat can be obtained with a minimum expanse of water.

The first principles of the new method of spat or 'seed-culture,' which I here propose, are the following: —

1. Oyster embryos diffuse themselves throughout the three dimensions of a body of water, and will affix themselves to collecting surfaces similarly distributed, up to and even above low-water level.

2. The floating fry will adhere to smooth surfaces as well as rough ones.

3. The surfaces upon which spatting occurs must be kept as free as possible from sediment and organic growths, in order that the very tiny young

mollusks may not be smothered and killed during the most critical period of their lives.

4. Artificial fertilization of the eggs of the oyster is feasible, and will become an important adjunct to successful spat-culture.

5. The water charged with embryo oysters may be passed through a steam-pump without injury.

6. Oyster fry usually adheres most freely to the under surfaces of shells or other collectors, because the lower side is cleanest, and most favorable to the survival of the animals.

7. The spat of the oyster will grow and thrive with comparatively little light.

8. The specific gravity of the water may range from 1.003 to 1.0235.

9. The most favorable temperatures of the water for spatting seem to be from 68° to about 78° to 80° F.

10. Spatting will occur just as freely in ponds or tanks with a free circulation as in open water.

These are the elementary principles upon which we must base our new method. All have been verified by observation, and none of them are hypothetical; but to give an account of all the data upon which they are based would take up too much space here. The methods of spat-collecting used in Europe are too cumbersome and expensive; besides, they are inefficient when applied to the American oyster, largely because of its low price. The thing to do is to arrange the collectors in such a way as to expose an enormous area of surface to which the billions of fry, swimming about in the water, may become adherent. To effect this it is proposed to provide a pond, natural or artificial, and connect it by way of a long, zigzag canal with the open water. The area of the pond, for a good reason, should be about the same as that of the canal. The canal and pond should be of about the same depth, or contain about three and a half feet of water at low tide. No filters are needed, except, perhaps, a screen at the mouth of the canal to keep out starfishes, large crustacea, and predaceous gastropod mollusks.

The canal is provided with ledges near the top, at about the level of low-water mark, to support the receptacles for the cultch. These are formed of vertical wooden strips six inches wide, six feet long, and secured parallel to each other, and three feet apart, by a cross-piece at the top, and two horizontal side-pieces six inches wide, secured two feet six inches from the top of the vertical pieces. Coarse galvanized wire netting is then secured around the edges and lower ends of the vertical strips below the two parallel cross-pieces. This netting will then form, with the wooden frame, a basket three feet wide, three feet deep, and six inches thick. Such a basket will
somewhat over three bushels of oyster-shel
cultch. The two cross-pieces which projec
yond the vertical pieces will support the recep
with the shells which it contains. One of
receptacles is allowed to every running fo
canal, in which its position is vertical. Th
ceptacles are therefore placed six inches apar
pond forty feet square, and accommodatin
bushels of spawning oysters, on two superim
platforms, will supply enough fry for a can
feet long, and holding 1,200 bushels of she
cultch in 400 receptacles. The latter will co
the lowest rate for material and labor, $5
hundred, or $200 for 400 feet of canal.
bushel of oysters will yield about one billi
eggs and fry. The pond, with its hundred bu
of spawning adults, will therefore yield abou
billions of fry. This vast multitude of o
brood will be wafted back and forth throug
collectors by the tides 360 times during the sp
season, which lasts for ninety days. That
billions of fry will be wafted through 1,200 bu
of shells 360 times during the season, thus ins
the fixation of the largest possible percents
embryos. The shells can be kept clean by v
ing the receptacles on the ledges which su
them. It will thus be seen that on one-ten
an acre I can place as much cultch as could
narily be placed on four acres. Or, by my me
on one acre I can put down as many she
could be put on forty acres by those who si
sow the shells; that is to say, the busine
getting 'sets' for planting in the open water
be so condensed as to cover only one-fortie
the ground now covered. After the lapse of n
days, the cultch, with its adherent spat, is rem
from the collectors, and sown in the open w
The method is therefore solely for the purpo
propagating the oyster, and commends itself a
most feasible in the Chesapeake region, wh
is hoped that private enterprise will esta
nurseries where seed-oysters alone will be
vated, to supply the demand for planting
beds. Thousands of acres of the flat, m
land skirting the Chesapeake and Chinco
bays are available, and may now be conv
into establishments for the culture of oyster

The plans set forth above are justified in det
the facts observed by myself in the course o
experiments instituted by me during the last
years, under the auspices of the U. S. fish
mission. In nature the theory is also abundan
verified, as, for example, at Wood's Holl, Coha
and Fortress Monroe. The fullest justificatio
the conclusions above presented is also given
the results obtained at Cherrystone in 1881, an

St. Jerome's Creek from 1880 to 1885; while the most conclusive and irrefragable evidence is that obtained as the results of experiments instituted by Professor Brooks and Messrs. Blackford and Mather during the present year.

The maximum efficiency of the cultch is not realized in any of the old forms of collectors, for the reason that the cultch cannot be kept clean; second, because both sides of the cultch cannot be exposed to the passing fry; third, because the fry cannot be forced to pass over and amongst the cultch repeatedly; fourth, because the cultch has hitherto been scattered over too great an area, and throughout only two dimensions of a body of water, namely, its horizontal extent, whereas it is possible to do far more; that is, to avail ourselves of the possibility of obtaining spat throughout the three dimensions of a body of water charged with embryo oysters in the veliger condition. These are good and sufficient reasons for my assertion that cultch has hitherto been wastefully and unscientifically applied.

The new method outlined above will be explained in detail, with plans drawn to scale, in an extended illustrated article of mine now ready for publication by the U. S. fish commission. In fact, as a result of scientific inquiry, it has come about that there may be applied a more effectual means of diminishing the mortality and frightful waste of oyster embryos, which occur under the stress of those natural conditions which determine the 'struggle for existence.' This result was predicted at the close of a lecture delivered in 1883 by Professor Huxley, in these words: "I, for my part, believe that the only hope for the oyster-consumer lies first in oyster-culture, and, second, in discovering a means of breeding oysters under such conditions that the spat shall be safely deposited. And I have no doubt that when those who undertake the business are provided with a proper knowledge of the conditions under which they have to work, both these objects will be attained."

JOHN A. RYDER.

PASTEUR AND HYDROPHOBIA.

PASTEUR'S communication upon the treatment of hydrophobia by inoculation, to which reference was made in a recent number of *Science* (Nov. 6), is fully and authoritatively reported in the *Comptes rendus* of Oct. 26. His present results are based upon a series of experiments upon rabbits and dogs, extending over a period of three years. So numerous have been these experiments, and so uniform and certain their results, that he has no hesitation in applying these results to other animals, including man.

Pasteur finds, that if a rabbit be inoculated by trepanning the skull, and placing beneath the dura mater a bit of spinal cord from a dog which has died of rabies of the streets (*rage des rues*), the animal always develops hydrophobia after a period of incubation of about fifteen days. If from the spinal cord of this first rabbit a second be inoculated in a similar way, and from the second rabbit a third, and so on in regular series, it is found that the period of incubation becomes shorter and shorter, until, after the virus has thus passed through forty to fifty rabbits, the duration of incubation is reduced to seven days. The incubation has remained at this point for a series of ninety inoculations, and it shows no tendency further to decrease. The virus has now reached its highest degree of intensity, and it remains of a constant quality. It is possible, therefore, to have such a pure virus of rabies at all times at disposal.

If portions of the spinal cord of rabbits which have died of this intense rabies be cut out with every precaution to prevent contamination, and if these portions of cord be suspended in a dry atmosphere, the virulence of the poison progressively disappears until it is completely extinguished. The time required for the extinction of the virus varies somewhat with the thickness of the cord, but especially with the temperature. The lower the external temperature, the longer the virus lasts. To preserve the cords, Pasteur places them in flasks, in which the air is rendered dry by bits of potash in the bottom of the flasks. It is possible, therefore, to have the virus of rabies in all degrees of intensity.

In order to render a dog refractory to hydrophobia, it is necessary to inoculate him with a series of spinal cords from rabbits dead of rabies, beginning with cords containing the weakest virus, that is, the cords longest preserved, and ending with cords containing the most intense virus, that is, cords preserved only one or two days. The animals are inoculated every day with cords representing successively each day or each two days of preservation. The inoculation is effected by injecting beneath the skin a Pravaz syringeful of sterilized bouillon in which a fragment of the spinal cord has been rubbed up. In this way complete immunity to the disease is established; so that, after the treatment is finished, the animal can be inoculated either subcutaneously or beneath the dura mater, with the most intense rabid virus, and no symptoms of hydrophobia appear. Pasteur has fifty dogs, of all ages and of all races, which in this way, without a single failure, he has rendered refractory to hydrophobia. The treatment is effectual even if it be applied after the dog has been

bitten by a rabid animal. Experiments are now in progress to determine how long an interval may elapse before the treatment ceases to be effectual. This interval is at least a number of days.

In the case of the boy Joseph Meister, who was successfully treated by this method, Pasteur began the inoculation sixty hours after the reception of severe bites by a rabid dog. The first inoculation was with a portion of spinal cord which had been preserved fifteen days. The treatment lasted for ten days; in all, thirteen inoculations were made, each one with a cord one day fresher than that used in the preceding inoculation; at the last inoculation there was used a cord preserved only one day, and containing a virus which produced rabies in a rabbit in seven days; that is, a virus more malignant than that in the bite of a dog affected with the rabies of the streets. The boy was kept under observation, and at the time of Pasteur's communication — three months and three weeks after the bite — no symptoms had developed.

After Pasteur's communication, Vulpian advised that a service be organized for the treatment of rabies by Pasteur's method.

Pasteur is unable to explain in what way immunity is produced by his method of inoculation. He thinks that the virus is altered in quantity rather than in quality by his method of preserving the cords. He notes the interesting fact, that, if the cords are preserved in a moist atmosphere of carbonic acid, with oxygen excluded, the original virulence remains unchanged, even after several months.

The full details of Pasteur's experiments upon animals, with description of symptoms and of *post-mortem* examinations, will be awaited with great interest. It is a matter of regret that we are not informed as to the nature of the virus, which, indeed, does not seem to have been discovered. It is probable that Pasteur's studies in this direction will lead to fruitful results.

A large number of observations are necessary in order to establish the efficacy of Pasteur's treatment of hydrophobia in human beings. His results certainly warrant a belief that, if the treatment be begun soon after the reception of the poison, this otherwise most hopeless and dreadful disease can be prevented. Should this belief become a proven fact, then Pasteur will merit the gratitude of all mankind.

THE PLAINS OF BRITISH AMERICA.

STRIKING contrasts present themselves to the experienced eye between the plains of British America, through which the lately finished Canadian Pacific railway has laid its tracks, and those crossed by any of the transcontinental lines in the United States. In the first place, they are larger. It is more than 1,000 miles from where the forested granites of Keewaydin dip under the Silurian prairie-floor in the Red River valley to the first escarpments of the Rocky Mountains. In Kansas it is hardly half as far between the wooded region and the foot-hills of Pike's Peak.

Another feature is the prairie-like look of it all, save certain far-western tracts. The grass is dense and long, flowering herbage is profuse. West of the South Saskatchewan this gives place to a greater, more 'plains' like scantiness of vegetation, to be sure, but nowhere is the bareness and aridity of the southern plains equalled.

This is due to the greater moisture in earth and air, and to the extraordinary fertility of the soil: Manitoba producing an average of 21¼ to 22 bushels of wheat to the acre, or 4 to 5 bushels in excess of the average of any other similar space on the continent. The soil is coal-black, and declares its richness at first sight. Dr. Robert Bell, of the Canadian geological survey, discussed the causes of this fertility before the Canadian royal society, May 23, 1883. He pointed out that the materials were the best possible, having been derived from the glacial drift of the north, mingling sand and gravel with the cretaceous marls spread over all British America. Having this favorable constitution, Dr. Bell assigns to the moles the chief agency in the formation of the thick top-layer of vegetable mould which is now the joy of the farmer. In the Assiniboine valley the moles have thrown up almost every foot of the soil into hummocks, each containing a large shovelful of earth, and burying completely the grass and vegetation over a space a foot or more square. The vegetable matter thus buried decays, and becomes incorporated with the soil; so that the process is analogous to ploughing under the soil. This work of the moles not only enriches, but refines the soil. In making their burrows, they select the finer material and cast it up to the surface, leaving behind the coarser. The effect of this is similar to that alleged by Darwin of the earthworms (which do not exist in the north-west territories), since, in the course of time, all the stones are buried. Their labor is supplemented by that of the gophers, spermophiles, and badgers, the last named digging deeply, and heaving up large quantities of gravelly subsoil, which the moles work into and improve, while all bury much ve[illegible] and food. This ben[illegible] ceases, how[illegible] stony 'thir[illegible] Missouri. [illegible] approa[illegible]

About 100 species of trees and shrubs are recorded as growing on the north-western plains, while the list of herbaceous plants is a very long one. A good many noxious weeds have been introduced with civilization, and some flourish most aggressively. The worst pests are Canada thistles, wild mustard, oats and buckwheat. The Thlaspi arvensis, or mithridate mustard, commonly known as 'penny cress,' is a great nuisance in the Red River valley, where it sprouts and flowers in spring, surrounded by snowbanks, and exposed to severe frosts. Sunflowers rise abundantly wherever the soil has been disturbed, and ought to be utilized. Insect and fungoid pests to crops are remarkably scarce, though the Rocky Mountain locust has at times invaded the Red River valley.

The grasses are many, and those called 'buffalo-grass' attract the first attention. True buffalo-grass (Buchloe), however, is not found north of the boundary. The buffalo-grasses of that region are Butchelona oligostachia, representing the gramina grasses of the south-western United States; and Stipea spartea, more often called 'spear-grass,' or by several names indicating what Dr. Holmes calls its 'diabolish' characteristics. The young spring leaves of the Stipea spartea are the most succulent and nutritive of all the prairie-grasses, which, as a rule, are harsh and sedge-like; they are short, and form themselves into tussocks (most noticeably in dry uplands), which, though useless in making hay, provide a very valuable pasturage. It spreads over the entire north-west, and is most plentiful on the buffalo plains, where it stood as the staff of life to the vast herds of wild cattle once ranging those limitless opens.

The peculiarity which earns for it the evil names 'spear-grass,' 'wild oat,' etc., belongs to the fruit. The covering of the seed is about seven-eighths of an inch long, and terminates in an excessively hard, sharp, and obliquely curved point; the extreme tip is bare, but close behind are set stiff, fine, silky hairs, all pointing backwards and upwards. The seed is borne at the end of an awn, which is kinked and twisted in a peculiar way, so that when dampened it gradually straightens out with a corkscrew motion, the effect of which (whatever its 'design') is to force the spear of the seed forward and spirally into whatever it happens to be pressed against, while the barb-hairs aid the penetration and prevent easy withdrawal. Darwin's experiments with '[illegible]' of an allied but less formidable [illegible]unata) will be remembered; while [illegible] of the Linnean society of Lon- [illegible]an account of experiments [illegible]y R. Miller Christy.

[illegible] the middle of July, and are at that time troublesome, as they have the power of penetrating the clothing and pricking the skin painfully. An insect-collector finds them a great nuisance, since they knit his net into hard knots in a short time. Woolly-haired dogs are tormented by them, and this grass has always been dreaded by sheep-owners and cattle-herders. Most of the stories told of it, nevertheless, are gross exaggerations, though it is true that they do get into wool badly, and sometimes penetrate the skin. On the extensive sheep-ranges at the foot of the mountain it is now customary, before stocking a certain range, to burn over one-half of it a year in advance, before the spear-grass has had time to ripen. The sheep are introduced to the new grass the next spring, and feed upon it while the remaining half of the range is burned. When that is ready, they are moved and the first half is reburned. By this means the spear-grass is said to be got rid of in two or three years, and will not return so long as the sheep remain.

Horses and cattle live upon this grass on the wild plains without harm. Prof. John Macoun of Ottawa told me that in seven years of plains travel his horses had never been harmed. The object of the mechanism of the awn apparently is to insure its planting by being pushed well into the ground; this accomplished, the awn soon rots off, and the seed germinates. Mr. Miller, in his Linnean society paper, points out how the buffalo paid for his pasturage by transporting the seeds of this best of grasses in his rough coat, extending its distribution by planting them wherever his mats of shedding wool fell off in the spring. Thus this beast constantly widened its feeding range, and provided for its increase in numbers. Of course, this grass was not the only plant thus carried by seeds north, south, east, and west, by the migrating herds; nor was the bison the only animal whose hairy coat would carry the clinging awns.

The buffaloes have abandoned all the region south of the Saskatchewan since 1878. Even their bones have been pretty thoroughly picked up. The little tributary of the Qu'Appelle River, upon which Regina, the capital of Assiniboia (province), is situated, is called Pile of Bones Creek, after a great heap of bones, chiefly bovine, which formerly lay upon its bank where the Crees had a favorite camp-ground. It would have been a 'bonanza' for the archeologist, doubtless; but an unscientific person shipped the whole heap away to Philadelphia and sold it, relics and all, at five dollars a ton. One sees all along the railway track now, just as used to be the case in Kansas and Nebraska, mounds of buffalo skeletons ready for shipment to fertilizer factories. At many

stations, particularly Moose Jaw (which owes its name to the shape of the bend in a creek there), you may buy excellent specimens of buffalo-horns, somewhat polished, and bound together with forehead-hides or bead-embroidered flannel, — the work of Indians and half-breeds.

ERNEST INGERSOLL.

NEWCOMB'S POLITICAL ECONOMY.

IN illustrating the ease with which labor may rush from one channel to another in case of a change in demand, Professor Newcomb remarks on p. 115 that "a professor of one science can commonly teach another." If he had said that it is unhappily true that an ignorant and unthinking public often considers that a man eminent in one department is equally so in several or all other departments, or that it is a common but most vicious notion that a college professor of one branch might just as well be professor of another also — as, for instance, that the professor of Christian evidences and New Testament Greek may also take physics as well as not, — and that this absurd notion is at present one of the most serious obstacles to any real improvement of our educational system, he would have been very much nearer the truth, and, we cannot help believing, nearer to his own real opinions when in his soberer moments. Certain it is, at any rate, that if a man who had given the best years of his life to the study of political economy should wander over into the field of astronomy and physics, and undertake "to bring order into the reigning confusion," and "to give the subject a recognized place among the sciences by being the first to treat and develop it as a science," Professor Newcomb would be just the man to administer a severe and deserved castigation. The offence is none the less serious, because in this case we have a great and successful astronomer and physicist wandering over into the economic field and undertaking to set things to rights.

The fact is that the progress of modern science in every branch has been so great within this century, that he is a bold man indeed who thinks that he is entitled to speak as an authority even in two or three fields, though they be very closely allied. The mere work of mastering the facts which are necessary to enable one to speak with confidence has become so great in almost any of the more developed branches of human science, that it is the task of years to do this for a single branch, to say nothing of a half dozen. It is, however, perfectly within the power of an able man to write a treatise on a science of whose present status he knows next to nothing, which shall present the subject as it was some time in the past, provided he goes back far enough toward the beginning of things. This is just what the author has done in this book. If he had published it fifty years ago it would have been a valuable contribution to the subject. Coming at this late day, it is still valuable as an instance of how completely a man may enter into the ideas and thoughts of a past generation, and how skilfully he may re-present them.

There is no evidence in the style of reasoning in this work that the author is at all acquainted with the recent literature of the science either in England or on the continent. One great advance in economic science of the last twenty-five years lies in a change of its prevailing method. It has been affected in a most healthy way by the enormous progress of physical and natural science. It is reaching out to avail itself of their methods so far as possible. As a result of this new method, it has come to reject the old generalizations, and, while recognizing that they were exceedingly valuable in their time, and formed important, nay, necessary links in the chain of scientific progress, it now insists that we have ample evidence of their crudeness and incompleteness, and that, taking whatever may be left of them that is true, we must now look for valuable results to careful and far-reaching inductive study of the facts of our social and economic organism as the indispensable basis of new and more fruitful generalizations.

Of all this there is scarcely a trace in Professor Newcomb's treatment. He repeats exploded theories and almost universally rejected laws with the utmost naïveté as "principles which will be accepted by all who understand the subject." It is true that he calls attention, in his chapter on economic method, to the necessity of more exact definition and careful reasoning; but taken in connection with his actual treatment, it has much the same effect on the professional economist that would be produced on the physicist or astronomer by an attempt on the part of Wilhelm Roscher or Cliffe Leslie to restate the corpuscular theory of light on the Ptolemaic system of astronomy with a greater exactness of definition, and closeness of reasoning. A work prepared in this latter spirit would doubtless have a value, as, for example, for disciplinary purposes in an old-fashioned college, but it would hardly be accepted by prevailing authorities as in any sense a productive contribution to the science.

Professor [illegible] written from old [illegible].

Principles of political economy. By SIMON NEWCOMB, Ph.D., LL.D. New York, *Harper & Bros.*, 1886. 548 p.

lowing out his own interest as he views it, will at the same time always promote in the most efficient manner the public interest. In speaking of ownership in natural agents, he remarks (p. 81) that "under our actual system the care which every prudent person takes of his own property is extended by the owners of natural agents to their property, and thus the contents of the great storehouses of nature are protected from waste." Surely the author knows of the great devastation of our forest lands by private owners, bent on following their own interest to the exclusion of that of the public. He has surely heard of the revelations recently made in England and Ireland which showed that the productiveness of agricultural lands was permanently lowered by the policy of interference adopted by the landlords, and which led to most vigorous restrictions on freedom of contract in the interest of the community. Surely the author knows that in nearly every state in the union it has been necessary to pass laws for compulsory drainage of swamps, whose owners refused in some cases to have them drained at all, even at others' expense. These are illustrations of a law very different from that enunciated by the author, and that is, that the interest of the individual diverges at a thousand points from that of the whole, and that positive legislation is needed at all times to secure the interests of the latter as against the former. Professor Newcomb himself, indeed, almost immediately takes back the statement quoted above by admitting that we have to depend upon law and public opinion to control private interest; but as he repeats the former statement in many different forms, and founds his whole system of *laissez-faire* upon it, we must accept it as his real view.

As a fair specimen of the mode of reasoning, we may refer to the investigation begun on p. 513, as to whether "any system intended to limit the liberty of any man to acquire all the wealth he can by legal means, and to employ it in the way he chooses, can conduce to the general good." The question, as stated, involves a *petitio principii*. By *legal* means? What does this phrase 'legal' mean? It is evident that the author is thinking of the means which are legal under our present system of laws in this country. But he is trying to get formulas for a general political economy which shall hold good of present, past, and future societies alike, and our laws are not the same as ey were a century ago, or as they will be a cen- 'o come; nor are they the same as English or r German laws. Nobody denies a man's all he can by legal means, but very leny that certain means now legal are judicious, and promotive of the public good. The author evidently goes upon the assumptions that our present laws are just and natural, and that any thing which is legal under them is also just and natural,—two assumptions which constitute the whole point in dispute. He sums up the discussion in the remark that "the fact is, that on our present system the enjoyment of the collected wealth of the community is as nearly in accord with the ideal principles of equity as any general system can be." This sounds like a voice from the dead. It is worthy of the worst period of 'Manchesterism.' It is this kind of political economy, which, regarding the case as closed in favor of the existing order in its present form, has done and is doing more to promote the most dangerous type of communistic and socialistic spirit and doctrine than all the vaporings of so-called professorial socialism of the last generation. Even John Stuart Mill declared that communism or socialism could not be any worse than the existing order, if this order is capable of no improvement.

If, passing over this fundamental view, which is, of course, the most important consideration in the case, we look at the details of the book, we shall find much to admire. The qualities which have made the author one of the most eminent astronomers of this generation serve him a good turn in his discussion of several of the most important topics. There is a general tone of fair-mindedness which is often lacking in works written from the general stand-point of the author, and which makes one only regret still more keenly the author's lack of special knowledge, which, if it had been supplied, might have given us a really valuable work. Some misstatements of facts should perhaps be noticed. The discussion of the national banking system was evidently written several years ago, and not revised to date. There is an unhappy confusion of the labor party with the socialists, which again reveals the author's ignorance of actual facts in the social organism of which he treats. In his discussion of bimetallism, he says that the government goes on the assumption that "the values of equal weights of the two precious metals have a certain fixed ratio," — a statement which is not true as a matter of fact, and is a gross caricature if intended to represent the views of bimetallists. E. J. JAMES.

TEXT-BOOK OF BOTANY.

NOTWITHSTANDING the rapid multiplication of text-books within recent years, it is a pleasure to

Gray's botanical text-book. Physiological botany, part ii. By G. L. GOODALE. Philadelphia, *Ivison, Blakeman, Taylor, & Co.*, 1885.

...is a most ... for in- ...ady has already ... and it only ...on to the larger ... are devoted to ...

...ly welcome from ...est work of the kind ... The nearest approach ... T. Bessey. Until now ...epend upon reprints ... text-books upon this very ... botanical science: but it ... ue of the work before ...manent change in this ... the future we may have ... capable of bringing the stu- ... acquaintance with the most ...

...ship, the book is very credit- ... improvement upon the usual ... The paper and letter- ... while the figures, of which the ... granted the author a fairly liberal ... an evident effort having ... stereotyped illustrations,—and ... admirably well executed. The refer- ... literature of the various subjects treated ... will be found a most valuable ... also will the large amount ... matter embodied in the footnotes. ... also provided at the end of the ... a large number of suggestions as to ... and materials required in both ... and physiological studies. Also, as ... advantage to those wishing to follow ... course of study, there are many ... suggestions as to the subjects which may ... profitably considered. Valuable as such ... are, however, they can only serve as a ... and the student must of necessity outline ... course to a very large extent, since he ... otherwise find it physically impossible to ... all that might seem desirable.

The author has endeavored to leave no im- ... physiological fact without discussion, while his entire treatment of the subject as a whole will commend itself to teachers generally ... clear and logical, although in many instances ... appears to be a lack in fulness of treatment which would be highly desirable, but which would hardly be practicable in the limits of a book designed for an ordinary course of instruction.

In some instances, however, this be ... fault, since the abbreviations are some ... to such an extent as to give the ... imperfect conception of the subject discussed. Such, however, are minor faults, and are almost inseparable from necessary curtailment of discussion. They all readily disappear under the guidance of a competent teacher, and the author is certainly to be congratulated upon having reduced errors of all kinds to a minimum. While giving the most recent views obtained, the author wisely errs on the side of prudence in not allowing himself to give too great weight to opinions which are not fully justified.

Our knowledge of both histology and physiology is now advancing at such a rapid rate, that many errors of omission, and possibly, in some cases, of fact also, are almost inseparable from a work of this kind. The time which elapses between the reception of the manuscript by the publisher and of the book by the public, is sufficient to make many statements old, and often to upset previous views. Bearing this in mind, the book is fully up to the times, and we can commend it as destined to meet in a most acceptable manner a long-felt want.

HORNADAY'S TRAVELS IN BORNEO.

ALL things considered, this is one of the most satisfactory books of its kind that we have seen for many a day. Its author possesses to a marked degree the happy but rare faculty of knowing just how much science the general reader likes to have mixed with his narrative, and also how to give it to him without missing either the science or the narrative. Mr. Hornaday's style is none of the best, but there is such a freshness, such a genuine ring, and such a realness to his narration, that one is willing to overlook his many deficiencies in the art of expression, his numerous inelegancies, and even his incessant use of slang words and phrases. In fact, the most serious objection we have to the book lies in another direction, and is something for which the publisher is more to blame than the author. We refer to its weight, — a little less than three pounds avoirdupois. Now, there is no objection to printing dictionaries and other works of reference in large, heavy tomes. Such books are designed merely for reference, and can be used when lying open on a table or book-rest. But when it comes to asking one's readers to sit solemnly down to a narrative of sport and adventure as to a Webster's unabridged or a consular report, it is asking too much.

Mr. Hornaday's journey to the jungle — which simply r... — was undertaken for the r... cimens for Mr. Ward's ...

... WILLIAM T. HORNAD...

well-known establishment at Rochester. From a commercial point of view, the venture must have been very successful, although our author was compelled, while in Ceylon, to bottle his snakes and fishes in methylated spirits, upon which the Ceylon authorities had collected a duty of four hundred per cent. He protested in vain, for the money had been paid by his bankers before his arrival on the scene, and the customs authorities refused to refund, even when he offered "to take the unlucky case of spirits through the custom-house, and bury it in a quiet corner of the back-yard, where it would not smell bad." The officers only replied, 'Couldn't do it, couldn't do it.' 'They had those rupees,' our author declares, 'and meant to keep them.'

Naturally, in the course of two years in the jungles of Ceylon, India, Selangore, and Borneo, one has many hair-breadth escapes. But the adventure, which he asserts was "ten times more dangerous than any I experienced with the head-hunters of Borneo," was experienced much nearer home. It was while engaged in skeletonizing some jackasses in the Emerald Isle that he was set upon by 'a mob of wild Irishmen,' who assailed him with long-handled hoes, on the ground that the donkeys had been murdered. He was finally allowed to depart by stealth, after having been boycotted for a few days, with his own bones intact, but without his asinine skeletons. These quotations will serve to show not merely the author's unhappy lack of skill in expression, but also the pleasant and truly American way he had of looking on mishaps which would have driven the average British sportsman to the *Times* or an insane-asylum.

One of the quaint features of the work, and one which we should have been very sorry to miss, is the way in which he loses the sportsman and narrator in the collector, and naïvely tells us where this or that stuffed effigy can be found. Thus, after describing an elephant hunt, and the subsequent skinning at a time when the elephant was several days older than when he died, he adds, "The old tusker, who fell under such romantic circumstances on the Animallai slope, now stands, still 'the monarch of all he surveys,' in the Museum of comparative zoölogy of Harvard university, Cambridge, Mass.

The whole volume is entertaining, though the most interesting portion, perhaps, is that wherein Borneo, with its head-hunting Dyaks, its tree-jumping gibbons, and its unpleasantly human orang-outangs, is described. Without disparaging the work of Wallace, Bock, and others, this is the best description of Borneo, so far as it goes, to be found in the books. Our author views the Dyak in the innermost recesses of his house, and tells us how he eats, drinks, sleeps, dresses, and earns his living. It is worth noting that Mr. Hornaday takes issue with Wallace as to the maximum height of the orang-outang, which Wallace gives as four feet and two inches. Our author and his hunters killed or captured forty-three, no less than seven of which measured more than four feet two inches; one, a Simia Wurmbii, measuring, when fresh, four feet and a half from the top of his head to the sole of his foot.

We wish that there was space to describe the manner in which Mr. Hornaday captured crocodiles with hook and line, and many other curious feats; but it is impossible. The book is finely illustrated with sketches, photographs, and a few other pictures. It further contains two moderately good maps, and but for its bulk would be a most welcome addition to the library.

ASTRONOMICAL NOTES.

First observation of Nova Andromedae. — The earliest observation of the new star, thus far reported, was by M. Gully, director of the public observatory at Rouen, on Aug. 17; and as M. Tempel, director of the observatory at Florence, affirms that it was not visible on the 15th and 16th, we are not likely to get much nearer the time of its first appearance. In *l'Astronomie* for November, which gives the above facts, M. Trouvelot also states that a 13 mag. star, which precedes the *nova* about 20ˢ and is a little south of it, and which is now visible with an 8-inch, is not put down upon a drawing of the nebula which he made in 1874 with the 15-inch of the Harvard college observatory, and that he does not think it could have escaped him if as bright then as now. It would seem as if this nebula were an object that should be watched pretty constantly, and of which a series of comparable photographs at stated intervals would be especially valuable.

Wire-gauze screens as photometers. — Of late years the use of wire-gauze screens, one or more in number, over objectives, has come into use for several purposes. Over one of the halves of a heliometer-objective they are used to reduce the image of a bright star to approximate equality with that of a fainter star from the other half, an essential condition for the most accurate superposition of the two images. With a meridian-circle they are used to reduce the brighter stars to an approximate equality with the faintest that can be observed with satisfactory precision, or to investigate the difference of personal-equation for different magnitudes by taking different tallies of transit-wires, with screen off and on, at the same

transit. In the latter case Professor Holden points out the necessity (*Astr. nachr.*, 2690) of changing the illumination of the field with the change of screen, so that each magnitude may show against its customary degree of color, or brilliancy of background. Such screens may also be used for photometric purposes when once their co-efficients of transmission have been determined. Those having occasion to use them in this way will do well to consult a paper by Professor Langley (*Amer. journ. sc.*, xxx. 210) on this subject. In this it is shown that the effective transmission co-efficients are decidedly different according as the luminous image is an extended surface, or practically a point like a star. In the latter case there is a central image surrounded by a system of diffraction images, into which a large part of the light goes; so much so, that Professor Langley found that a screen (of which one and two thicknesses transmitted .47 and .21 respectively of the full light upon a surface) gave only .18 and .02 for one and two thicknesses respectively, when measured by the brilliancy of the central image of a small pinhole as a source of light.

Comparison stars. — M. Folie, director of the observatory of Bruxelles, Belgium, announces that he also is ready (see *Science*, vi. 427) to determine the apparent places of comparison stars for comets and asteroids, if those desiring such determinations will communicate the approximate star-places to him.

Rhodope rediscovered. — On Oct. 3 Palisa found and observed (166) Rhodope, the search for which we before noted (*Science*, vi. 333) as the occasion of the discovery of (250).

The coast-survey system of longitudes. — In Appendix 11 to the coast-survey report for 1884, Assistant Schott rediscusses all the telegraphic longitude work thus far done by the survey, including the three transatlantic cable-determinations of 1866, 1870, and 1872. The whole work now includes 158 individual determinations of $\Delta\lambda$. Of these, 53 belong to a network covering 33 stations extending from Paris to Omaha, thus furnishing 21 rigorous conditions to be fulfilled by the longitudes of the 33 stations, a much stronger system than that discussed in the report for 1880. The average probable-error of single determination of $\Delta\lambda$, including every thing since the origin in 1846, comes out $0^s.038$, as determined *a priori* from the observations themselves, or only $0^s.016$ as the average since 1878, when improved methods were introduced. From the residual corrections, however, which result from the discussion, as necessary to make the 53 values of $\Delta\lambda$ satisfy the 21 rigorous conditions, the probable-error of a single $\Delta\lambda$ comes out $0^s.048$, indicating, as compared with $0^s.038$, that there are still some outstanding errors, pro ably of observers' personal-equation, which the *priori* probable-errors do not cover. There only one resulting correction to an observed val which reaches $0^s.1$, while in the latest adjus system of European longitudes, which involves measures with 26 conditions, although the aver probable-error of a $\Delta\lambda$ comes out only $0^s.035$, there are six corrections to observed values wh exceed $0^s.1$. It will be seen that the Ameri work compares very favorably with the Europe while it includes the three difficult transatlan cable links. Mr. Schott has accepted the decis of the Meridian conference, and in his final ta prints longitudes east of Greenwich as +, west as —. He has also gone through the tedi process of computing the probable-error of a fu tion of adjusted values for the longitudes of Ca bridge and Washington, which come out —

Cambridge, $\lambda = -4^h\ 44^m\ 30^s.993 \pm 0^s.041$,

Washington, $\lambda = -5^h\ 8^m\ 12^s.038 \pm 0^s.042$.

An interesting paragraph at the end shows t the rather remarkable agreement in the th transatlantic determinations of the longitude the Harvard college observatory, as given in t report for 1874, was more an agreement of adju ment than of observation, and that the observ values have really a range of $0^s.13$. This is t most complete discussion of a network of lon tude determinations yet made, and it well susta the high reputation which the scientific work the coast survey bears at home and abroad, w much of which is due to the thorough work Assistant Schott and his efficient computing vision.

NOTES AND NEWS.

What is in some points a remarkable circul is prefixed to the current number of the *Zeitschr für philosophie und philosophische kritik*, t most conservative and old-fashioned of periodica The management of the *zeitschrift* announces new policy in view of the tendency of the b thought of the day, which is "to strive for a vival of the idealistic view of the universe, it be compelled thereto not less by practical than scientific considerations." Therefore the polem cal character of the *zeitschrift* will cease, reason for it having been removed. In the seco place, the vast amount of criticism will give w to explanatory sketches and sympathetic notice new books and results, so that no investigat may have injustice done it at the hands of a viewer of an opposite school. More attention i be paid to the historical aspect of philosophy the social sciences, and in especial will the w of countries other than Germany receive its sh

ention. This liberal programme is a cheer-
gn, and only shows that even the ultra-
rvatism of this old-established journal has
o yield to the spirit of modern progress.

Dr. Currier of New York has invented an
atus by which the large class of deaf persons
have some small amount of latent hearing
earn to speak with greater uniformity and
ness. The difficulty is that the person af-
hears only the voice of the teacher or the
er through the tube, but does not hear his
ones. To accomplish this, a tube goes first
the mouth to the ear of the deaf person, and
there to the mouth or ear of the speaker.

A stalactite cavern has been discovered in a
lled Kalksberg, near Wolmsdorf. The work-
were quarrying for marble, when they unex-
lly broke into the cavern, which they ex-
l for about a mile and a half. In some
there were deep ponds, and an inner cavern
found that could only be entered by means
adder; they have only explored the cavern
imperfectly as yet.

M. Duclaux, a disciple of M. Pasteur, has
studying the effect of sunlight on germs of
itic life. For three years he has been watch-
ubes containing cultures of Tyrothrix scaber.
organism grows very well in milk, or in
g's infusion, by destroying albuminoid mat-
pathogenic bacteria do. Drops of milk con-
g the organism were taken at the moment of
formation, and enclosed in glass tubes plugged
cotton wool, so as to exclude external germs.
milk having been evaporated, some of the
containing the remaining spores were ex-
to various degrees of sunlight for various
ls, — a few days, a month, two months, a
summer. Others were placed in a stove at
perature equal to the maximum of tropical re-
, in the dark or in diffused light. Eventually
quantities of milk were introduced into the
, so that the spores might be provided with
means of growth. None of the tubes sub-
l to warmth, but sheltered from the sun, have
d sterile, — a fact which shows that the spores
e microbe in question, even after being re-
l in a dry state and subjected to tropical heat
hree years, do not lose their vitality if shel-
from the sun's light. Fifteen days' exposure
e light produces no observable effect, but
a month's exposure germination becomes ob-
ly slower, while 50 per cent of the tubes ex-
l for two months have proved sterile. Spores
cted to sunlight proved much more feeble in
g's infusion than in milk; that is, a much
r proportion of the tubes remained sterile after a given exposure, if development in the former beverage was attempted, than if the latter was the medium of culture. Hence we must infer that not only is sunlight a powerful hygienic agent, but that much depends upon the character of the liquid to which a disease germ obtains access. M. Arloing has tried similar experiments with the formidable Bacillus anthracis, the organism associated with that malady so destructive to sheep, which, when transmitted to man, is known as the terrible wool-sorter's disease. He finds not only that sunlight has an attenuating influence, so that by its aid the germs can be converted into a vaccine, but that the influence can be transmitted and intensified through several generations. A spore born of a 'solarized' bacillus is more susceptible to the reforming influence than its parent was.

— The Henry Shaw school of botany, in Washington university, St. Louis, was opened on the 6th of November by an inaugural address given by the professor, Dr. Trelease, which has been printed. While the school bears the name of its founder, and will in due time take its full development in connection with the Missouri botanic garden at Tower Grove, the first professorship, as we are delighted to learn, commemorates in its title the late Dr. Engelmann. By this address the earnest and judicious young professor begins to open the eyes of the St. Louis people to the breadth, the interest, and both the educational and practical importance, of the subject which he is to teach.

— Felix Plateau has recently published (*Bull. soc. zool. France*) a series of interesting experiments on the palpi of insects, the results of which are quite opposed to the current idea that these oral appendages are essential both to the recognition and the seizure of food. He found that beetles, cockroaches, etc., may be deprived of either the labial or maxillary palpi, or both, and still retain the power of identifying and masticating their food. It is very curious that the function of such well-developed organs should so entirely elude us.

— The Congress of German anthropologists will meet at Stettin next summer. Prof. Hugo Lemcke, president of the City college, as chairman of the local board of managers, tenders an invitation to be present to all American students of anthropology desirous of attending the congress at Stettin, where they will meet Virchow, Schliemann, Schaffhausen, and others, and where their presence will be especially appreciated by the cordial hospitality of the Stettiners. Mr. E. Lemcke, of B. Westermann & Co., New York, will undertake to forward applications.

— Prof. W. D. Holmes, of the photographic laboratory, Lehigh university, offers a prize of fifty dollars for the best instantaneous shutter for out-door work presented before Feb. 1, 1886. Further information can be obtained of C. W. Canfield, 1321 Broadway, New York.

— The secretary of the treasury has appointed Mr. Artemas Martin of Erie, Penn., librarian of the coast and geodetic survey, having first consolidated the archives with the library. This will be gratifying news to the many readers of *Science* who have long held Artemas Martin in high esteem as a mathematician and a man.

— The December number of the *Botanical gazette* is to be a laboratory number, but will contain, in addition, a full description of the memorial vase presented to Dr. Gray, with illustrations of both sides.

— The fourth series of the 'Johns Hopkins university studies in historical and political science' (beginning in January, 1886) will be chiefly devoted to American city government, state constitutional history, and agrarian topics. Among the monthly monographs will be the following: Dutch village communities on the Hudson River, by Irving Elting; Rhode Island town governments, by William E. Foster; The Narragansett planters, by Edward Channing; Pennsylvania boroughs, by William P. Holcomb: Introduction to state constitutional history, by J. F. Jameson; City government of Baltimore, by John C. Rose; City government of Philadelphia, by Edwin P. Allinson: City government of Chicago, by F. H. Hodder; City government of St. Louis, by Marshall Snow; City government of San Francisco, by Bernard Moses; City government of New York.

— A unique institution is the Anthropological school of Paris. A good idea of its comprehensiveness is gained from its programme for the coming year. There are no less than six courses of lectures. M. Mathias Duval lectures on zoölogical anthropology, including comparative embryology and kindred topics. General anthropology is in the able hands of Dr. Paul Topinard, whose lectures will centre about the discussion of races and types. M. Manouvrier lectures on ethnology, giving special attention to normal and abnormal craniology. Medical geography, by which is understood the action of the environment, is the subject of a course by M. Bordier. The remaining courses are on Prehistoric anthropology, by M. Gabriel de Mortillet; and on the History of civilizations, by M. Letourneau. The lectures are held weekly, and, in addition, conferences are held from time to time. The course of lectures was begun on Nov. 9.

— Dr. Topinard has published a revised series of anthropometric instructions for travellers. The traveller, he says, need not trouble himself with questions of race, but should merely observe varieties of type. For this purpose he should take measures of as large a number of individuals as practicable, ten different measurements of one hundred individuals being more valuable than fifty of twenty-five persons. The measurements must be so simple as to reduce the personal equation as low as possible. They should also be so arranged as not to keep the subject in one attitude any longer than necessary. Men should be selected for measurement rather than women. All the instruments required may be collected into a small anthropometric box, the slide being the most useful. Dr. Topinard furnishes a form for recording results and remarks.

— M. Mercadier recently described before the Paris academy of sciences experiments undertaken in order to show that the elasticity of the metal diaphragms at the extremity of telephonic wires counts for nothing in the transmission of sonorous vibrations, or rather that it merely gives to the voice the nasal tone associated with telephonic conversation. M. Mercadier successively substituted for such diaphragms plates of greater and greater thickness, pieces of cardboard, and finally iron-filings. The intensity of the vibrations was diminished, but the tone of the voice became normal, and the most delicate inflections were transmitted with perfect exactitude.

BOSTON LETTER.

Visitors to Boston many years ago were struck by the then novel sight of large labels attached to the stately trees on the Common, designating their scientific and common names and the country of their origin. This simple device for the instruction of the public was almost entirely the work of a single public-spirited man, the late Dr. A. A. Gould, the naturalist, whom more than one generation of Bostonians held in the highest esteem. Snatching the early hours from a laborious practice, he could be seen by early risers tacking his tins upon one tree after another for a whole season. After his death, I think it was, when these had grown dilapidated, some city forester, who, like many others since appointed, had no other than political claim to the place, instead of restoring, removed them. All efforts since made to renew the work have failed until now, when, thanks to the energy of a few interested persons, and the personal attention of Mr. John Robinson of Salem the Common has again become a good botanic object-lesson.

The terrors of the ravages of white ants in tropical countries came vividly to mind a few years ago, when Dr. Hagen of Cambridge announced material damage to old documents in our State House to be the work of a native white ant. Similar destruction having already been reported in the archives of Springfield, Ill., the matter excited no little concern. There was no question of the damage done, though the state officials were somewhat relieved at finding it mainly concerned ancient tax papers of no other than historic interest, and was confined only to a single apartment. I mention it now only to state that it is to this room that the papers of the Board of health, lunacy, and charity have just been consigned, and that the recent discovery of two large timbers used in the construction of an old house on Beacon Hill, not far from the State House, so riddled by these insects as to render them unfit for further use, shows that the peril was not magnified by the learned entomologist.

One of the most successful efforts made here in recent years for public instruction in science has been carried on under the auspices of the Natural history society, and latterly through the assistance of a portion of the Lowell fund, which has so long supported the Lowell institute courses of lectures. It owes its origin mainly to the deep interest and financial aid of Mr. John Cummings, a vice-president of the Natural history society, and its steady growth to the personal attention of Professor Hyatt, the curator of the society. The Teachers' school of science, as it is called, inaugurated and maintained under these auspices, has now an assured existence, is thoroughly appreciated by the public-school teachers of the vicinity, and has received the warmest praise from the highest school authorities. It has just commenced its fourteenth year with a course of ten lectures, or, more properly speaking, object-lessons, on worms, insects, and vertebrates, by Professor Hyatt, which is to be followed by a mineralogical course given by Professor Crosby. This year Professor Hyatt has had prepared for his course, among other things, two or three hundred dissected kittens, the internal organs being preserved in place and in form by a species of tanning, which renders them as plastic as a kid glove, and permits their free and cleanly handling. In this way, parts which before could only be explained by diagrams, can now be examined by each member of a class, and their relations to all the surrounding parts seen and studied personally (each one is even allowed to retain a set of the objects used), — an advance which will be thoroughly appreciated by every promoter of object teaching. Admission to these lessons is free to teachers holding tickets, which are distributed on application to the public-school authorities; and the courses are so popular that the society's hall has long been outgrown, and the large Huntington hall of the neighboring Institute of technology has been brought into requisition.

Last week, Wednesday, the veteran botanist, Dr. Asa Gray, celebrated his seventy-fifth birthday. It was made memorable by the presentation to the learned and genial professor — still as active a worker as at forty — of an exquisite silver vase of charming proportions, "in token of the universal esteem of American botanists;" the vase itself being completely covered, above its fluted base, with a floral design, in which, in *repoussé* work, are exquisitely delineated choice flowers of the American flora named for Dr. Gray, or in other ways specially significant of his work, with others which have been his favorites. The idea was originated and carried out by the editors of the *Botanical gazette*, and was a complete surprise to Dr. Gray, who was profoundly moved by this pleasing proof of the general affectionate regard in which he is held by his collaborators. The presentation was entirely informal, and was made by Professor Barnes, one of the editors of the *Gazette*, temporarily residing in Cambridge, who placed it in Dr. Gray's hands, with the personal cards of the 180 botanists who contributed to the vase, many of them accompanied by a few words of congratulation, placed on a silver salver having the inscription: "Bearing the greetings of one hundred and eighty botanists of North America, to Asa Gray, on his seventy-fifth birthday." Among the many other remembrances he received was the following pleasing quatrain sent by Mr. James Russell Lowell:—

> "Just Fate, prolong his life, well spent,
> Whose indefatigable hours
> Have been as gayly innocent,
> And fragrant as his flowers!"

The week has also witnessed another event of personal and scientific interest. The dinner given to the designer of the Puritan by the scientific club of the city, to which reference was made in a former letter, came off last Friday, Mr. Burgess having consented to comply with the wishes of his friends. Although the club is a small one, numbering only about sixty members, who meet once a month for a dinner, generally to the number of from twelve to twenty, no less than forty gentlemen, including a few guests, sat down to the table, after which Mr. Burgess entered into a few interesting details concerning the construction of the Puritan.

Y.

Boston, Nov. 23.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The English sparrow.

This bird seems to be on trial for its life before the American people. The charges against it are so indefinitely and loosely stated, that a cautious judge would be obliged to rule out a very large part of them. The bird is charged with many misdemeanors — such as tyrannizing over our native birds, and driving them from our home grounds, gardens, etc., to our great loss and damage; to leaving the insects which they were imported to destroy largely unmolested; to robbing our grain-fields and storage houses; to befouling our roofs, rain-gutters, pipes, and walls of buildings, to the entire destruction of our rain-water supplies, etc. Words of praise are few and far between. The fact is, it has got a bad name, and with the usual result, — every one is ready to cast a stone at it, whether he knows any thing against or for it.

Whether the object of its importation — the destruction of worms and insects in the city parks — was a success or failure, I know not. My impression from the general reports is, that it is largely, if not entirely, a failure.

The sparrow is an active, hardy, and persevering bird: it has already possession of the New England, the middle, and the western states to the Rocky Mountains, and perhaps of the southern. From 1870 to 1873 I saw them in possession of the towns of the Missouri River valley, from Kansas City, north to Omaha. Probably the lower valley to St. Louis was occupied before this, as St. Louis had been previously settled. Whether they had progressed then north [illegible] I do not know.

Mr. Ridgway, in Science, vi. 418, says, "In the western and western states, beyond the Mississippi River, the bird has not been observed." This is a mistake so far as the western states are concerned, and may be so for the southern. I saw them also in [illegible], Nebraska, W[illegible] west of the Missouri River, and in Denver, Col., in 1873.

They seem to follow the great thoroughfares of [illegible], probably attracted by the scattered grain [illegible]. In 1873 I saw them on the [illegible] Pacific railroad, from Kansas City to St. Louis, and [illegible] Pacific railroad.

[illegible] have a marked preference for [illegible] in the [illegible] and about [illegible] in the [illegible] and about [illegible] and [illegible] and [illegible] and

SCIENCE.—SUPPLEMENT.

FRIDAY, NOVEMBER 27, 1885.

A NEED FOR A CAREFUL STUDY OF THE HISTORY OF CHINA.

WHEN it is remembered that the Chinese writers have hardly any conception of history in our sense of the term, that their most renowned historians give us little more than annals or chronicles, the dead and fleshless bones of history, we cannot complain that Fries's history of China, which is a condensed translation of Chinese writers, is not a rich and flowing narrative. It is simply a bald outline of the succession of sovereigns and dynasties, of the tricks and vices by which the throne was often won, of the military achievements of the rulers, and of the divisions and reunions which the territory of the empire has undergone. Of the condition of the people through the long period of their national existence, of their progress in arts and learning, of the philosophy of their institutions, of the solution of the problem of their survival of all the destructive influences which have wrecked every other nation, we hear nothing in this book, because the Chinese chronicler has said nothing of all these to the translater and compiler.

It is greatly to be desired that some competent scholar should make a careful study of Chinese political history and institutions, in the spirit in which Sir Henry Maine has studied the institutions and laws of ancient and mediaeval Europe and of India. There is reason to hope that not a little light could be thrown by such study on certain European institutions and traditions. Why should not the careful investigation of Chinese feudalism, which had run its course, and perished centuries before feudalism sprang up in Europe, yield results most interesting to the student of European feudalism? Why should not the careful study of the village organization in China, which probably has scarcely changed for three thousand years, add to the light which Mr. Maine's study of the village communities in India has thrown upon the primitive life of Europe? Who that has observed the common responsibility of the dwellers in a Chinese street, for the preservation of order in that street, has not been reminded of the old Saxon frank-pledge? Is the resemblance accidental, or is there an historical basis for it? The day cannot be far distant when western scholars will be giving to such subjects the attention they deserve. A profound knowledge of the Chinese language, exhaustless patience in ransacking the voluminous literature of China, and a thorough investigation of existing usages and laws in towns and villages of China, will be necessary for the successful prosecution of such work. But the facilities for mastering the language are now so great, and the opportunities for coming into close contact with Chinese life and thought are so rapidly increasing, that the younger scholars need not despair of accomplishing what has hitherto been impossible, but what may prove a most valuable contribution to the history of institutions.

JAMES B. ANGELL.

Abriss der geschichte China's seit seiner entstehung. Nach chinesischen quellen übersetzt und bearbeitet von Sigmund Ritter von Fries. Wien, *Frick*, 1884.

PRODUCTIVENESS.

THERE are many problems of a biological nature which, when applied to man in particular, assume an economic aspect. The statistics of the birth and death rates, of the growth of populations, of the number of children per marriage, and so on, belong to the biologist as well as to the political economist. The interest of the former is a little broader, because similar statistics for other animal species would have considerable value for him, while the economist would hardly care to spend time on this side of the question. Owing to this close relation of these biological and economic questions, it sometimes happens that the latter tries to answer the question about which the biologist is the judge, or *vice versa*. The last French census has given the economists a chance to reproach France with the charge of sterility, implying as it does that the sterility is the result of voluntary determination. M. Gaetau Delaunay[1] denies the justness of this reproach, and holds that the decrease in productiveness observed in the French people is a biological fact which must be explained by an examination of the natural conditions which control the production of offspring.

The lower species of plants and animals are more fertile than the higher. The female of the white ant lays 60 eggs per minute; a queen bee deposits 5,000 to 6,000 eggs annually. In vertebrates, fecundity diminishes as we rise from fishes to reptiles, from reptiles to birds, from birds to

[1] *Revue scientifique*, Oct. 3, 10, 1885. The editor of the *Revue scientifique* records in a footnote the death of M. Delaunay just as these papers went to press.

mammals. In a general way there is an inverse relation between the number of offspring and the size of the animal. (This may indicate why many of the mammoths are extinct.) While the lower species is more productive, the life of the individual is much shorter. This inverse ratio between the productiveness of the species and the longevity of the individual is a very fortunate arrangement: for, according to the estimation of M. Quatrefages, two successive generations of the offspring of a single plant-louse would cover eight acres, and the fish would fill the sea in a man's lifetime. Again: in the lower organisms the mortality is great: very many die before reaching maturity.

Inferior races are more prolific than superior races. The finest varieties of fruits bear least. Dog-fanciers testify that the most intelligent varieties have the fewest young ones. In man the lower races are most productive. Among the Kafirs twins are said to be as common as single births, and triplets frequently occur. The black race is more fertile than the white. One authority gives 5.45 children for each white woman, and 5.62 for the colored. The Chinese occupy less than 1-20 of the surface of the globe, and yet their population includes nearly 1-3 of the human race. Among European nations Russia and Spain are the most productive, Switzerland and France the least.

The inference to be drawn is not that in France the forces of maternity are shirked, but that the natural effect of a high civilization shows itself in the diminution of fertility. Nor is it a mark of decadence, for the Swiss nation shows a similar phenomenon. Again, while Spain and Italy show a higher prolificness, the longevity is lower. The average life is thirty-one years in France and is forty years. France has more persons from fifty to sixty years of age than other countries. What is lost in quantity is gained in quality. The number of children per marriage has been decreasing from 1800 to 1871 [illegible] but the mean life has increased. From 1801 to 1805 it was 37 years 8 months; 1861 to 1870, 39 years 5 months; 1871 to 1878, 40 years 6 months. In other countries of advanced civilization, the fertility though still high, is on the decrease. England, Austria, Prussia, — all show the same state of affairs. These nations will in time exhibit the same low rate of increase as is shown in France now. An adequate explanation is the change in the relations of the sexes: the sterility is the law that the ratio of marriages to the population has not been decreasing in France, and is now as high as elsewhere.

The young are more fertile than the old. Young vines give a large harvest, but the grapes are poor. Buffon states that at 18 women are more productive than at 30; according to an English authority, fertility increases up to 25 or 30 years, and then diminishes. To-day the French woman is 24½ years old, the man 29 years 7 months, at the time of marriage. In the eighteenth century they were 19 and 25 years respectively. The result is that to-day the fertility is less; but the quality of the offspring is better.

Within certain limits a weak temperament favors fertility. Domesticated animals have more offspring than wild ones. A vigorous active life apparently does not favor longevity. Tailors and shoemakers have more children than blacksmiths. The ancient athletes and the modern acrobats seldom have children. War kills off the strongest men, and leaves the weak to propagate the race: hence the birth-rate increases. From 1811 to 1815 it was 3.49, but from 1816 to 1830 it was 4.06 in France.

Brain-workers and intelligent people have fewer children than others. Sixty-one married professors of the medical faculties of Paris, Lyons, and Bordeaux, had only 1.75 children to each marriage. The mortality among these children, however, was very low: and so in general, the offspring of these more evolved, less fertile classes is of a stronger, larger, and higher kind. *Force engendre faiblesse.*

There probably is a limit below which propagation is impossible: but there is surely a limit of the high manner, above which reproduction is lowered: and the maximum fecundity is a state nearer to the weak than to the excess of good nature.

In the more advanced races a famine increases the birth-rate. The poor are notoriously prolific of offspring. But the offspring of the wealthy classes is longer lived. Finally, as to climate: the fertility is higher in warm countries, but the mortality is lower in the north than in the south.

Precociousness is a characteristic of the lower species and races, of the younger individuals, of the weak, and [illegible] and mentally. There is antagonism in these relations between quality and quantity of offspring. All circumstances that favor increase in plants and animals act equally when in man, and hence in the French nation as well. The diminution in fertility observable in other European nations as well as the French is a [illegible]

The [illegible] Programs, etc., are ready to receive items in these lines and materials, and especially [illegible] in advance.

fact: it is determined by natural conditions, and not by the voluntary decision of individuals.

J. J.

A SUGGESTION FROM MODERN EMBRYOLOGY.

ONE of the obstacles which proved to be a difficulty of considerable weight to Darwin in his application of the descent theory was the sudden appearance of a highly developed fauna in the Silurian age. This difficulty has not decreased, but has rather increased with the further knowledge of that fauna. The primordial fauna, as shown by the fossils of the Silurian rocks, was not what naturalists would have assumed had they been called upon to construct this fauna from *a priori* grounds. Instead of a few simple generalized forms, these early rocks showed evidence of a highly diversified fauna. In the Silurian rocks are represented all of the great divisions of the animal kingdom, including even the vertebrates. Moreover, of the smaller divisions, a sufficient number are here represented to cause considerable surprise. About five-sixths of the orders now existing, nearly an equal proportion of sub-orders, a great many families and some genera of to-day are found in these earliest rocks. It is indeed remarkable to find such a very large number of existing groups represented in the earliest fauna of which we have any knowledge. It is true that the Silurian age lasted a long time, and that in the lower Silurian the fauna is not quite so diverse as above indicated; but even here it is sufficiently diverse to be surprising. When the history of vertebrates since that time is compared with the history of other groups, the contrast is very striking. They have had time enough to develop from the very lowest forms — which we judge lived in the Silurian times — into the present highly diversified groups. But with all other groups of animals the advance has been comparatively small. It must be assumed, to reconcile these facts with evolution, that enough time elapsed between the beginning of life on the world and the beginning of the Silurian to develop all of the sub-kingdoms except the vertebrates to a high degree of differentiation. And, when the great amount of time which it has required to develop the vertebrates is taken into consideration, the amount of lost time necessary to assume previous to the Silurian seems too great to be credible.

It will, of course, never be possible to reconcile the Silurian fauna with evolution without the assumption of a long lost period of this character. But certain general results from modern embryology are in this connection suggestive, and indicate that the difficulty is not so great as has been sometimes conceived. For modern embryology is teaching us that our various sub-kingdoms are all direct modifications of the most primitive multicellular animal. Using embryology as a guide in interpreting animal history, naturalists have been continually shortening this history, particularly at the bottom. From the time when Haeckel traced the genealogy of man through twenty-one stages, these stages have one by one been dropped by naturalists, with the result of making the history a much more direct one. Finally, the recent theories of Sedgwick, and others who follow him wholly or partially, would make the history of all animals much shorter by showing that all the sub-kingdoms may be regarded as resulting directly from modifications of the gastrula by slight changes in its shape. We once derived the worms from the coelenterates, the annelids from the lower worms, and the vertebrates from the annelids; but now all of these groups are derived directly from the gastrula itself. This theory of Sedgwick is receiving support in some form from many sources — at least, so far as concerns this feature of it. There is certainly a tendency to-day to look upon a greater and greater number of types as direct modifications of the original animal represented by the gastrula stage. Coelenterates, polyzoa, brachiopods, mollusks, annelids, and vertebrates have all been shown to be derivable from the gastrula by simple direct modifications.

Now, we must remember that slight variations at the bottom of a diverging series produce much greater effects than variations higher up. When a tree is first sprouting, differences in the direction of its buds determine the shape of the future tree; for these early buds become the great branches, and the slightest difference in their direction is enough to cause a wide separation between them as growth goes on. After the tree has grown to a considerable size, its buds no longer produce great branches, but only small ones, or perhaps only twigs. Growth cannot now change the general shape of the tree, but only increase the profusion of small branches, twigs, and leaves. That such a relation represents the history of the various groups of the animal kingdom is unquestionably the teaching of modern embryology.

The significance of this result in enabling us to understand the fauna of the Silurian rocks is evident enough. It not only shortens the time necessary to be assumed prior to the Silurian, but it also enables us, partially at least, to understand the presence at this early period of such a large number of our present existing types. For the protozoan to develop into the first multicellular animal, represented by the gastrula, must have

taken a length of time of which we have no means of getting an idea. But after this animal was developed, the origins of the various great types were not serial, but simultaneous. This animal began to be modified in various directions to fit its surroundings, and the result was a rapid divergence of groups. Slight variations in these simple types would cause the descendants of the various lines to separate still further. We can therefore imagine the Silurian times to be somewhat close to the origin of life, and yet not be surprised at the existence of all the greater divisions of the animal kingdom, and many of the smaller ones. We can also understand why it is that the development of most groups since that time has resulted chiefly in the increase of the abundance and diversity of small branches. For the Gastrea, having diverged into several great branches, has itself disappeared as such, and can of course produce no new sub-kingdoms. Development must now take place within the branches, and must confine itself to smaller and smaller particulars as evolution progresses. Modern embryology, therefore, showing as it does the early divergence of the great types, offers to us an explanation both for the highly diversified fauna of the Silurian age, and for the comparatively less importance of the development that has taken place since that time, even though post-Silurian times be recognized as very much longer than pre-Silurian times. And we are finally led to believe that the vertebrates also were much more abundantly represented in this fauna than the scanty remains hitherto discovered would indicate.

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POLITICAL SCIENCE IN FRANCE.

As M. Donnat well remarks, politics in France have been largely based on sentiment and abstract reasoning rather than on the lessons derived from observation. Frenchmen are confessedly adepts in constitution-building, but so little acquainted are they with the practical history of political methods that they have not yet arrived at the stage of regarding politics as an art, much less as a science. It is well, therefore, to notice these two works[1] as written in the spirit of comparative politics. M. Donnat maintains that there is a science of politics whose principles are as unvarying and determinate as the laws of the natural and physical sciences. A political solution may be compared to the product of the two gases in fixed volumes to form the molecule of water; nor is there any higher power to introduce uncertainty in the operations of political forces. This is no new thought; and if the English reader wishes to understand the significance of such political inquiry, free, however, from the particular irreligious character of M. Donnat's thinking, he is already in possession of the suggestive work by Sheldon Amos on 'The science of politics.' While the latter has the advantage in philosophic treatment of the subject, the former is more imperative in his claims for the purely scientific nature of politics. He is constantly suggesting parallel illustrations from the other sciences, and derives much comfort from a contemplation of the methods employed by Claude Bernard in his development of the science of medicine. M. Donnat's spirit of inquiry, nevertheless, is admirable, and one sure to be fruitful in its results. He is animated by the spirit which prompted De Tocqueville, Comte, and Le Ploy. Like the first, he has travelled much abroad: and his knowledge of English and American political life extends even to the details of such legislation as our homestead laws. In early life he hoped to find in Comte a guide, but this master soon turned aside, and became a divinity. In Le Ploy, also, he well-nigh found a kindred spirit; but, instead of persisting in those remarkable studies of the civic and industrial institutions of European society, this profound thinker also was drawn into immature synthesis, in declaring that religion was indispensable for private and public life. With M. Donnat it is ever observation and experimentation in politics. The former, on account of the complexity of political phenomena and political Daltonism on the part of the observer, is insufficient. It must be supplemented with experiment. The great success of the Swiss, English, and Americans has been due to their adoption of this principle. Their legislation is not only of local application, but limited in time; and the different legislative assemblies of England's colonies are compared to so many political laboratories. In France, however, legislation is indiscriminating. The colonies have no local voice. An enactment of the Palais-Bourbon is as far-reaching in its provisions as the limits of the most distant colonial possessions. Nor is legislation of that tentative character which should be the spirit of all genuine scientific inquiry. The author, therefore, earnestly pleads that France cut loose from its hard and fast methods, and make trial of local and temporary legislation.

M. Guyot is even savage in his criticisms. The arraignment of French colonial policy is exhaustive in its details. The budgets and commerci statistics of colony after colony are taken up

[1] *La politique experimentale.* Par Leon Donnat. Paris, *Reinwald*, 1885.

Lettres sur la politique coloniale. By Yves Guyot. Paris, *Reinwald*, 1885.

skilfully analyzed to prove that no Europeans, except possibly Spaniards or Portuguese, can be acclimated in the zone lying between the isotherms twenty-five degrees north and south of the equator. Of the French colonies, Algiers and New Caledonia are the only ones not situated within these limits. From every point of view, the French colonial policy is shown to be disastrous. Neither the French race or language can thus hope for expansion. Even commercially it is a failure, for foreign nations can undersell France in her own colonies. French emigration is always fatal when it is perpendicular instead of parallel; and there can be no national advance until an intensive colonial culture be substituted for the extensive system so popular in this day. The work has many interesting points for the ethnologist to consider, such as the relations of European colonists with indigenous races. It is written with much force and even grim humor, as when the author, after analyzing the statistical situation of Algiers, sums it up with the picture of the twenty-five thousand productive colonists, each seated on four graves, and guarded by a brace of soldiers.

These two books are suggestive not only for their political philosophy of freedom, but also as furnishing clear and forcible views of the difficulties which stand in the way of French progress.

STARS IN RAPID MOTION.

THE small value of the parallax of 40 o^2 Eridani (*Science*, vi. 358), combined with its large proper-motion (4″.10), brings it into prominence as the third or fourth of the stars, moving rapidly across our line of sight. Since a list of these stars seldom appears in works on popular astronomy, we give below the proper-motions μ, the parallaxes π, and the resulting velocities v, in miles per second across our line of sight, of the eight stars which head the list in the order of velocities. The method of deriving the velocities is of course very simple. If a star's annual proper-motion equals its parallax, it moves across our line of sight each year a distance equal to the semi-major axis of the earth's orbit. (How much it moves to or from us can only be told by the spectroscope.) Therefore, since this motion increases directly as μ, and inversely as π, we have for the annual motion across the line of sight —

$$v\,t = a\,\frac{\mu}{\pi},$$

or, calling a 92.5 million miles, and t the number of seconds in a year, we have for the velocity in miles per second —

$$v = 2.93\,\frac{\mu}{\pi}$$

Of course, the proper-motions below are much more accurately known than the parallaxes, and where the latter are small the values of v are correspondingly uncertain. The authorities for the adopted values of π are given in the column following them. In the case of 40 o^2 Eridani, we have weighted Gill and Hall 2 and 1 respectively, as the former determination was made under much the more favorable conditions, and rests upon two comparison-stars. The latest values of Hall and Ball for 61 Cygni are practically identical. The probable errors of all the values of π are generally less than 0″.02.

Star's name.	μ	Parallax.		v
		π	Authority.	
Groombridge 1830....	7″.05	0″.09	Brünnow	230
Lacaille 9352.....	6 .96	0 .285	Gill.....	71
40 o^2 Eridani	4 .10	0 .185	Gill and Hall.....	65
ϵ Eridani	3 .10	0 .14	Elkin.....	65
ϵ Indi.....	4 .68	0 .22	Gill and Elkin.....	62
Lalande 21258.....	4 .40	0 .27	Auwers.....	48
61 Cygni	5 .23	0 .48	Hall and Ball	32
Lalande 21185.....	4 .75	0 .50	Winnecke.....	28

The first will be recognized as Newcomb's 'runaway star,' so graphically described in his 'Popular astronomy;' but it will be seen that the others have velocities which are at least comparable with that of Groombridge 1830, and indicate momenta that represent vast amounts of energy. The discovery of huge suns like our own rushing through space with these great velocities is a matter of more than usual interest just now, from the fact that Mr. Denning's claimed discovery of fixed meteor-radiants has raised the question as to the possible existence of broad swiftly flying streams of meteorites in inter-stellar space, moving with velocities entirely beyond the control of our sun, and so broad that it takes the solar system some years to pass through them. (An annual parallax of 1° in a meteor-radiant corresponds to a velocity of over 1,000 miles per second for the meteor-stream.) The idea of such streams moving with such velocities is a startling one, and, if shown to be true, gives a very vivid idea of the forces acting, or which have acted, in stellar space. It seems at first highly improbable that such can be the case, but with the hard facts of Groombridge 1830, and these other swiftly flying suns staring us in the face, the idea is worth considering, at any rate. If these suns are the products of condensation due to central attraction, so that the luminous energy by which they reveal themselves to us was once energy of translation, it is no violent assumption to suppose that some of their constituent parts were once moving with much greater velocities than that of the present whole. In fact, the man who should claim as a

possibility that space contains broad belts of small particles moving with velocities which are the resultant of all the forces acting on them since primeval chaos, and which have not yet been gathered under the control of any one of the stellar systems among which they are sweeping, would find [illegible] to confirm his ideas in these giant swiftly [illegible] suns. The question is certainly of sufficient [illegible] importance to call for a thorough [illegible] of the present methods of determining [illegible] radiants, for probably most astronomers [illegible] disposed to deny or [illegible] to the existence [illegible] of these so-called radiant-[illegible]

H. M. Paul.

ALPINE CRETINISM.

[illegible] is a peculiar form of idiocy which [illegible] Swiss writers is an arrest of intellectual [illegible] associated with very manifest malformations of the body and especially of the [illegible] Cretinism is commonly thought to be [illegible] [illegible] [illegible]

SCIENCE.

FRIDAY, DECEMBER 4, 1885.

COMMENT AND CRITICISM.

STUDENTS OF MAPS may have noticed upon nearly all maps of Colorado issued during the past twenty years a settlement indicated upon White River, near the western boundary of the state, denominated Golden or Goblin City. This is a curious example of the persistence of a geographical blunder. Many years ago an army expedition traversed this region, going from Fort Bridger, Wyo., to old Fort Massachusetts, Col. In this neighborhood are bad lands, eroded into curious forms, which naturally suggest a ruined city; and the commander of the expedition gave the locality the name of *Goblin* City, which name appeared on his map. The map-makers, in their haste to fill up the blanks in this unsettled region, jumped to the conclusion that this was a veritable settlement, and gave it a place on their maps, — a place which it has ever since retained. Not only have the commercial map-makers, almost without exception, fallen into this error, but such authorities as the U. S. engineer office and general land office have adopted it. The name has, however, been gradually changed from Goblin to Goldin, and thence to Golden City, while more than one enterprising map-maker, reasoning, probably, that a city cannot exist without means of communication with other settlements, has constructed on paper a road down the White River to it. It is scarcely necessary to add that there is not, and never was, a settlement in this neighborhood.

IN THE APRIL ISSUE of the *Druggists' circular* appeared an offer by the publisher of three prizes for "the three most practical and otherwise valuable essays on disinfectants." In the May issue the following gentlemen were announced as the committee of award: Prof. S. A. Lattimore, Rochester, N.Y.; Dr. Henry B. Baker, Lansing, Mich.; Prof. Joseph P. Remington, Philadelphia. In the June number it was announced that nearly two dozen essays had been handed in, and several of them, selected at random, were printed in that and succeeding issues. Finally, in the October number, the successful names were announced: first prize, $125, to Mr. Marcus Benjamin, New York City; second prize, $75, to B. W. Palmer, M.D., Detroit, Mich.; third prize, $50, to R. G. Eccles, M.D., Brooklyn, N.Y. The essays all appear in a book issued by the *Druggists' circular*, entitled 'Disinfectants and their use.' From the editorial remarks made in the issue announcing the decision, we learn that the delay was caused by the difficulty of arriving at a unanimous decision as to the merits of the various essays, and that it was finally decided by a majority of the committee. From a letter which appeared in the *New York medical journal* of Nov. 7, we infer that Dr. Baker's was the dissenting voice. It is also distinctly stated in the announcement of the award that the decision of the committee is not to be regarded as an endorsement of the accuracy and scientific value of the essays, but is merely an indication of relative value.

The result reached by the committee has been in many quarters adversely criticised. Inasmuch as these essays were intended to meet the urgent demand for reliable disinfectants, in view of the possible advent of cholera, it is very unfortunate that they should be sent broadcast through the land, with what amounts to a statement that their accuracy and scientific value are not indorsed by the committee. Essays with these qualifications were called for, and, if they do not supply this want, they are of no more value than so many school-boy compositions: indeed, they may do infinite harm, as, this want of indorsement being overlooked, a false sense of security may be created in those who employ the remedies suggested, to the exclusion of means which have been found reliable and trustworthy. In the first six essays, there being twenty-one in all, we find no less than thirty substances mentioned as having disinfecting value; how many there are in all, we do not know. We can imagine the satisfaction which would be felt by one of those subscribers asking for "the most practical information in relation to disinfectants," for whose benefit these essays were obtained, when he turned to this volume for help.

WE HAVE RECENTLY received "Outline of matter and advance sheets of the Report of the

legislative, administrative, technical, and practical problems of irrigation, in course of preparation and publication, by William Ham Hall, state engineer, California." This outline is 304 pages in length, and is an exhibit of the character of the report in preparation, which will be in seven books, forming five or six volumes, of five hundred pages each, or from 2,500 to 3,000 pages in all. How the compilers are paid is not stated; but judging from the following sentence,—"Great public works, such as national roads, railroads, basins and docks, canals and the canalization of rivers, whether enterprises of the state, of departments, communities, or of particular companies, whether toll is to be charged in any way or not, or whether a subsidy of treasure is to be granted or not, or whether any part of the public domain is to be used or not, can only be executed by virtue of special law, which can be passed only after an administrative inquiry has demonstrated the feasibility and desirability of the work, and a report has recommended it,"— which is a fair sample of the book, we presume they are paid by the word; the idea evidently being that of quantity, and not quality. A thorough investigation of the problem of irrigation, as developed in the old world, with reference to the new, would be of almost inestimable value; but the work should be concise, stating briefly the old laws, the work done in each country, the necessity and uses of irrigation as drawn from these examples, the land to be irrigated in California, and the plan to be adopted. If the book had been written with these ends in view, it would have been generally read and widely useful. Now few will read it, for it is necessary to look for the facts in a volume of words as you would for a needle in a haymow. We trust the legislature of California will thoroughly revise the work, and see that it is made less expensive and more useful.

ALTHOUGH THERE HAS BEEN within recent years a great multiplication of biological journals in Europe, many of which, from the character of the articles they have published, take high rank, yet they have nearly all been in fact, if not in name, confined almost exclusively to physiology and morphology. This is especially the case with the zoölogical periodicals, none of the best of which touch, except incidentally, upon the systematic, geographical, or biological departments of the science. In three fields there are special journals, with their *clientèle* principally among amateurs. We refer to entomology, ornitl and conchology. There is certainly a gre of work in zoölogy, of great value and ir and quite outside of either morphology or p ogy. It would be a great convenience if could be a journal which included a large fi of the work of the character indicated.

We are glad to learn that such a journ be inaugurated in Germany, under th *Zoologische jahrbücher*, and the sub-title *schrift für systematik, geographie und biolo thiere*. It is to be edited by Dr. J. W. Spe Bremen, and published by Fischer at Jena. desired to give it a distinctly internationa acter, and it is hoped to secure the co-operat American zoölogists. The editor justly att special value to thorough monographs, eit large or small groups, from any part of the s kingdom, and to faunal papers. The divis the journal devoted to the life-histories of a ought to prove peculiarly interesting and val It is high time that something more was m these than mere curiosities — which, in most is all they pretend to be. Those who inten tributing will be pleased to know that article be published in German, French, Englis Latin; and that the authors are furnished forty reprints of them, besides being paid a s sum. That the new journal will be of a character, the editor's name assures us. Spengel is one of the best-known and ablest o younger German zoölogists. His memoirs on urogenital system, and on Bonellia viridis, a altogether exceptional value, and are familia all scientific morphologists.

THE MODE OF ADMISSION INTO TH ROYAL SOCIETY.[1]

OUR contemporary *Science*, in the last nur which has reached this country, makes s remarks concerning the admission of candi into the Royal society, against which, in th terests of truth and accuracy, it is our dut protest, the more especially as it is also im that the French system of canvassing those are already fellows of the society is also adop

The statements actually made are, 1°, that t is an "actual competitive examination, on result of which a certain number of succe candidates are annually chosen:" and, 2°, "tha English method has the additional disadvan

[1] From *Nature* of Nov. 19.

that it does not secure the men whom it is most desirable to honor." We read also, "During the school-boy period the distinction between different individuals is a distinction of learning, and an examination is not unfitted to discover the boy who deserves reward. But learning is not the quality which a state needs to make it great. Casaubons are not the kind of men who have built up English science. The qualities which ought to be encouraged, and which it should be a nation's delight to honor, are qualities too subtle to be detected by a competitive examination."

For the benefit of our transatlantic brethren, we may as well state the facts as we know them. For reasons into which we need not enter here, as they do not affect the question at issue, nearly forty years ago the Royal society determined to limit the yearly admissions to fifteen; and to throw upon the council the responsibility of selecting the fifteen who are to be nominated for election, a general meeting of the society reserving to itself the right of confirming or rejecting such nomination. It may be instructive to remark that for thirty years that right has not been exercised.

The way in which the matter is worked is as follows: The friends of a man, who are already in the society, and who think he is entitled to the coveted distinction, prepare a statement of his services to science, in many cases without consulting him in any way. This paper, thus prepared, is sent round to other fellows of the society, who are acquainted with the work of the candidate, and who sign it as a testimony that they think he is worthy of election. In this way, when the proper time arrives, some fifty or sixty papers are sent in to the council for their consideration. In the council itself we may assume that the selection of the fifteen is made as carefully as possible, in view not merely of individual claims, but of the due representation of the different branches of science. It is not for us to state the safeguards or mode of procedure adopted, but we think we may say that the slightest action or appeal to any member by the candidate himself would be absolutely fatal to his election. Finally, we may say that, years back, when a heavy entrance-fee had to be paid, there were cases in which the question had to be put to one whose friends were anxious to see him elected, whether he would accept election. The small yearly subscription of £3, now the only sum payable, makes even this question unnecessary at the present time.

[How does it happen that our English contemporary makes no allusion whatever to Professor Chrystal's address to the British association, which, as printed in *Nature*, gave rise to all our animadversions? — ED.]

HISTORY OF ANGLO-SAXON.

PROFESSOR WUELKER, although literary executor of Grein, and editor of the new 'Bibliothek,' has nevertheless found time to prepare a most useful book for all students of English literature and English philology. Ten Brink's excellent history was purely literary; something of the same kind, though less able, was Earle's 'Anglo-Saxon literature,' published last year. Quite otherwise with Wülker: he furnishes a supplement, not a rival, to Ten Brink's book, paying little attention to actual contents, but giving the fullest account of the new literature which has grown up by way of comment on the old. Ten Brink gave us a description: Wülker gives us a guide-book, — a much-needed help for the student, and a basis for all new work. Wülker's tone is judicial and dignified; his decisions are as impartial as one could expect; while the enormous labor involved in sifting so many dust-heaps — dissertations, programmes, etc. — cannot be praised too highly: for, though it is true that for one man who is able to write literature there are a thousand who can judge and classify facts, it is equally true that the thousand are sure to scorn facts, and rush into original work.

The first section of the book contains an account of Anglo-Saxon philology in different countries. From the first steps under Elizabeth and Archbishop Parker, from the worthies who thought that Anglo-Saxon was the speech of Adam in Paradise, the growth of this study, at first under legal and theological shelter, is carefully traced to our own time. Wülker's criticism of the earliest efforts is properly indulgent; otherwise with modern failures, as where Loth's 'Grammar' (1870) is neatly despatched with the remark, "What is right in the book is old, and what is new is wrong." We have pleasant glimpses of a woman, Elizabeth Elstob, editing and translating Aelfric's 'Homilies,' having audience of Queen Anne in the interests of Anglo-Saxon, and afterwards (1745) publishing the first Anglo-Saxon grammar written in English. A century later Miss Gurney makes the first English translation of the 'Chronicle.' For American scholarship Wülker has encouraging words, and remarks that Anglo-Saxon is much more studied here than in England.

The second section gives a list of all books which aid in the study of Anglo-Saxon philology and literature; and here one feels afresh the enormous preponderance of German scholarship. Aside from living scholars, what would our philology be

Grundriss zur geschichte der angelsächsischen litteratur, mit einer übersicht der angelsächsischen sprachwissenschaft. Von Dr. RICHARD WUELKER, ord. professor an der Universität Leipzig. Leipzig, *Veit & Co.*, 1885.

without the labors of Grimm, of Grein, and of Koch? Wülker's lists seem here and there somewhat meagre. Under 'Metrik' (p. 108) we miss Schmeller's 'Ueber den verstau der allitirierenden poesie' München, 1850, although this is mainly concerned with Old Saxon; and Lanier's 'Science of English verse' New York, 1880, which sets forth at length a theory of Anglo-Saxon versification. That the theory is untenable does not matter; for Wülker includes in his various lists quite worthless books (cf. p. 175). Further, we fail to find mention of Ellis's 'Early English pronunciation,' in which pp. 510–537 treat the pronunciation of Anglo-Saxon.

The third section, which takes up four-fifths of the book, considers Anglo-Saxon literature, and whatever has been written about it. The arrangement is arbitrary, 'Cædmon' and Cynewulf taking precedence of the heathen poetry. As regards the famous hymn in Northumbrian dialect written at the end of the Cambridge manuscript of Bede *Hist. eccl. gent. Angl.*, Wülker recedes from his supposed position of eight years ago, and joins Sievers and Ten Brink in believing this text to be Cædmon's own, or at least to have passed as such as early as the eighth century. Wülker admits the personality of Cædmon, but accepts as his work nothing save the hymn; whereas Ten Brink was inclined to credit Cædmon with a part of the 'Genesis.' Cynewulf is treated at length. While the 'Phœnix' is assigned to him, and the rest of Junius. Wülker brings forward fresh arguments against the Northumbrian origin of the poet, and discourages the tendency to ascribe poems to Cynewulf on no better basis than general resemblance to his undoubted works. Proceeding to the smaller and lesser poems, Wülker concludes with 'Judith.' The text follows not in a single, but in the mss of Bede.

For the heroic and heathen poetry we find besides much other matter some pages of well-selected information about 'Beowulf.' Wülker thinks the extant heroic poetry was in the shape of ballads and he assigns to the theory that 'Beowulf' was a unified whole about the middle of the seventh century. His summary is very thorough, but does not [illegible] Stark might [illegible] names as [illegible] Wülker might have added [illegible] Sievers [illegible] [illegible] [illegible]

Benin. Much weight attaches to the opinion of M. Mer, who is a retired naval officer of forty years' experience, including three years of cruising between the equator and Gibraltar on the west coast of Africa.

The journey of Messrs. Capello and Ivens in central Africa during the past two years was beset with exceptional hardships. The explorers proceeded from the limits of the Portuguese territory in the direction of Cubango, as far as the lower part of the Mucussu, where they found themselves in a barren region intersected by watercourses and marshes, which obliged them to turn northward through an unknown region infested with tsetse, and affording little food. Sixteen of their party died from tsetse-bites, without counting cattle and hunting-dogs. After travelling 4200 geographical miles, they reached Feté almost exhausted, having lost sixty-two men during the fifteen months. The explorers reached Lisbon on the 17th of September, where they were received by the king, and welcomed by an enthusiastic demonstration of their countrymen.

Paulitschke has studied the relations of the western branches of the Somali, and the north-eastern tribes of the Gallas, near the Gulf of Aden. His results, with a good map showing their distribution and the route of the author and his companion, Hardegger, are to be found in the September number of the Proceedings of the Geographical society of Vienna.

The Bulletin of the Italian geographical society for September contains extracts from the unpublished journals of Pellegrino Matteucci, the African traveller. These have been edited by Dalla Vedova, and are illustrated by a map showing the itinerary and also the routes of Nachtigal and Rohlfs. Matteucci's journey, one of the most remarkable on record, extending from the Red Sea at Suakin to Lake Chad, and thence to the Niger and the sea, has hardly attracted the attention it deserves; chiefly, perhaps, on account of the early death of this promising and brilliant explorer.

The third part of the Isvestia of the Russian geographical society, for 1885, recently received, contains an important map by General Tillo, showing the lines of equal horizontal and total intensity of terrestrial magnetism in European Russia for the epoch 1880. It is accompanied by two smaller charts for the middle of the nineteenth century, showing the secular variation of the same elements. The same number contains an abstract of the report of the work done by the topographical corps of the general staff during 1884, the important details of which have been already noticed in *Science*.

ASTRONOMICAL NOTES.

Occultations of α Tauri. — The occultations of this bright star and of a few of the other naked-eye stars of the Hyades will be visible again over a considerable portion of this country on the night of Dec. 19; but as the phenomena occur well on toward morning, they are not likely to be extensively observed. A most favorable opportunity, however, will occur on the night of 1886, Feb. 12, when a larger number of the stars will be occulted, and most of them early in the evening. Our observatories are so widely scattered that prediction for one place is of very little use for another (so rapidly does the parallax of the moon vary with hour-angle and zenith-distance), and each intending observer must predict them for himself with the data given in the *American ephemeris*. These recurring occultations of so many of the bright stars of the Hyades, which will continue for several years, afford pretty fair opportunities for a good determination of the semi-diameter of the moon, especially if the fainter stars (to the 8 mag.) can be filled in on a chart, and their occultations be predicted and observed at the dark limb of the moon. They also offer, to those who have the means of determining accurately their local time, but have never made a telegraphic determination of their longitude, the next best method of determining this, if they are willing to go through the somewhat tedious reduction of the observed occultations.

The shower of Biela meteors. — The earth received a visit, on the night of Nov. 27, from a part of the ghost of the lost comet of Biela, in the shape of a widely observed meteor-shower, a repetition of that of 1872, Nov. 27, and no doubt both of them parts of the meteor-stream which was once Biela's comet. It will be remembered that this comet separated into two during perihelion passage in 1845–46, came round in 1852 as two comets 1.5 million miles apart, with most extraordinary alternate fluctuations in brightness, and has been wholly invisible as a comet since then. But at its descending node, which the earth passes about Nov. 27, the comet's orbit closely approaches that of the earth, and an extraordinary meteor-shower from a radiant in Andromeda on 1872, Nov. 27, in which some single observers counted them at the rate of 4,000 or 5,000 per hour, has always been attributed to a meteor-stream into which Biela's comet is resolving itself. The present shower, so far as reports are at hand, does not seem to have equalled that of 1872, but it was a very decided one. At Georgetown, D.C., two of Professor Hall's sons and Mrs. Hall (the latter watching only a short time) counted 213 meteors between $6^h\ 30^m$ and $7^h\ 50^m$. Angelo Hall, who

makes the report, describes them as generally small, from 4° to 10° in length, with occasional bright ones with short trains. At the same place, Mr. D. Horigan, one of the naval observatory watchmen, who had had considerable experience in meteor-observing, gathered a party of four to watch in the four quadrants, and their combined count gave —

Number from	7h	0m	to 7h	30m,	100
" "	7	30	" 7	55 ,	100
" "	7	55	" 8	38 ,	100
" "	8	38	" 9	0 ,	28

At 9 o'clock it became hazy and clouded over. Mr. Horigan describes them as occasionally as bright as the 3d mag., with short trains; color, white or violet; but most of them faint, and some scarcely visible. He fixes the radiant near γ Andromedae. From Syracuse, N.Y., are reported a shower at 7h, in which 120 were counted, and another about 9h, furnishing a count of 130, with no statement as to clearness of sky. Professor Pickering telegraphs from the Harvard college observatory, "Great shower, radiant, χ Andromedae, observed at Geneva last night." The telegram is dated Nov. 28, and no doubt refers to Geneva, Switzerland. χ Andromedae is very near γ. Newspaper telegrams also report brilliant showers at Elizabeth, N.J., at Teheran (Persia), and at Naples and London. It is evident that this meteor-stream, with a period of about 6¾ years round the sun, is going to furnish an exceedingly favorable opportunity for studying the dispersion and distribution of comet material along its orbit.

NOTES AND NEWS.

During the past year the council of the New England meteorological society has engaged in the following branches of work: 1°. The securing of a corps of reliable observers of meteorological phenomena, with special attention to precipitation and temperature; 2°. The publication of the monthly bulletin; 3.° The dissemination of the daily indications of the U. S. signal service, and the local display of weather flags; 4°. The special investigation of thunder-storms. The work of securing reliable observations was so far advanced in November, 1884, as to warrant the issue of the first bulletin for that month, and its regular publication thereafter. The first bulletin contained reports from forty-five observers; that for September, 1885, from one hundred and twenty-three observers. As a result of the society's efforts, local weather flags are daily displayed in more than one hundred cities and towns of New England. The special investigation of thunder storms was made under the supervision of the secretary. More than four hundred observers co-operated, the largest number of reports for any single storm having been two hundred and three. The preliminary study of the reports thus far made indicates that some interesting results have been obtained, which will be reported upon subsequently. The original membership of the society was 9; the number at the close of the year, 95. The expenses of the society have been kept within its income, but this has been done through the generous co-operation of friends who have from time to time contributed liberally to its resources. In looking forward to the work of another year, the council suggests that special efforts be made to add to the membership of the society, as well as to the list of observers. It must be remembered that the financial prosperity of the society depends on the number of members. It is desired to include in the membership all who are interested in meteorological studies in New England, whether they make observations or not. A member need not be an observer, nor is it required that an observer shall be a member.

— The preliminary circular proposing the formation of a State academy of science in Indiana, issued by authority of the Brookville society of natural history, has elicited such a general response in favor of the movement, that the same society has issued a circular calling a meeting of all the people of Indiana interested, to be held at Indianapolis on December 29. In order that an understanding may be had of the present state of scientific study in Indiana, the following persons have kindly consented to present papers upon the several subjects mentioned: Richard Owen, M.D., Sketch of the work accomplished for natural and physical science in Indiana; David S. Jordan, M.D., Ichthyology; Prof. John M. Coulter, Botany; Prof. J. P. Naylor, Physics; R. T. Brown, M.D., Geology; Prof. O. P. Jenkins, Lower invertebrates; E. R. Quick, Mammalogy; Prof. Robert B. Warder, Chemistry; Prof. O. P. Hay, Herpetology; Daniel Kirkwood, LL.D., Astronomy; P. S. Baker, M.D., Entomology; Maurice Thompson, Mineralogy; Rev. D. R. Moore, Conchology; Sergeant Orin Parker, Meteorology; J. B. Connor, Statistics; A. W. Butler, Ornithology.

— In the general English and American magazines for November there are very few articles of scientific interest. The *Century* contains another illustrated paper on 'Typical dogs,' the various breeds of setters being this month the topic of discussion. There is a short account, by as many different authors, of the history and characteristics of the Gordon setter, the American setter, the Irish setter, the Llewellyn setter, and the modern English setter. Perhaps this article would be

more entertaining to a 'sporting man' than to one of scientific pursuits. In the *Contemporary review* there is a very interesting article, by Sir John Lubbock, on 'Some habits of ants, bees, and wasps,' in which the author tries to show that the instincts of flight in a 'bee line,' of cell-making, and of storing food for the young, really lie within very narrow lines, and are not inconsistent with the theory of natural selection. Some observations on the instinct and longevity of ants are added. There is an anonymous article on 'Fish out of water' in the *Cornhill magazine*, which is not worth reading, and another in the *Leisure hour*, by Mr. A. H. Molam, on 'Cornish coughs,' which is but little better. In this connection may perhaps be noticed a very readable paper by Ernest Ingersoll, in *Lippincott's magazine*, on 'The Peabody museum of archeology,' giving concisely the history and aims of this institution, with some account of the collections.

— The next meeting of the Society of naturalists of the eastern United States will be held on Tuesday and Wednesday, Dec. 29 and 30, at Boston. The executive committee has voted to recommend that the name of the society be changed to the American society of naturalists.

— At the last teacher's institute, held in Humboldt county, Cal., the Humboldt society of natural history was organized. Prof. J. B. Brown, principal of the schools at Eureka, was elected president, and Prof. Carl C. Marshall of Arcata, secretary. The secretary would be pleased to learn of names of works in various departments of natural history that are specially adapted to that region.

WASHINGTON LETTER.

THE museum of hygiene, in connection with the office of the surgeon-general of the navy, is not so generally or widely known as is the army medical museum. It has undertaken some investigations, however, which, if brought to a successful issue, will be of great value to the general public, and will not fail to bring it into a deserved prominence. The interest of a naval surgeon in hygienic matters arises primarily, no doubt, out of the fact that he has to do with the health conditions of men necessarily crowded into a small space. Whatever may have been the origin of this hygienic museum, it will be everywhere admitted that much can be accomplished by it if its management be wise and liberal. An important step has been announced by the surgeon-general in the statement that a complete system of iron and lead pipes, with fixtures, is being erected on the outside of the museum building for the purpose of making an exhaustive series of experiments, covering all disputed points in reference to trap siphonage and the utility of the mechanism of water-closets, traps, water-basins, baths, sinks, etc. Observing stations have been established at each of the three stories, and the investigation is to include microscopical and chemical tests of the action of sewer air and different waters on pipes and tanks. When completed, the results are to be at the service of the public.

In connection with this it is interesting to note a few statements contained in the report of the health officer of the district. The year ending June 30, 1885, shows a slightly increased mortality, this increase having occurred 'in classes of disease not dependent on hygiene.' The most notable feature is the marked difference in the rates of mortality among the white and the colored population, the latter being, as everybody knows, relatively larger than in most large cities. Among white people the rate has not, during the past decade, reached as high a figure as 20, while among the colored people it has been more than 40, and never less than 30. The mean rate for ten years is, for the whites, 19.02; and for colored people, 34.99; and on the whole population, 24.38.

An item of interest relative to both the above, is the existence in the city of a training-school for nurses. It was established in 1877 by members of the medical society, assisted by benevolent people of the city. At present its students number about thirty, and it is stated that thus far no men have applied for admission. Fourteen have been graduated, of whom ten are now in practice. Lectures are given twice a week by members of the medical profession. These are free to the nurses, and persons who do not intend to enter the profession are admitted on the payment of a small fee.

Readers of *Science* are aware of the fact that a little more than a year ago the director of the geological survey determined to undertake actively the study of seismology in this country. A conference of those most interested in the work, including representatives from the signal service and the naval observatory, was held, which resulted in an agreement upon certain plans for the investigation. Another meeting of this conference was held a few days ago, those present being Captain Dutton and Mr. Hayden of the geological survey, Professors Rockwood of Princeton, Davis of Cambridge, Paul of the naval observatory, and Marvin and Mendenhall of the signal service. It was generally agreed that the most important and decided advance in the study of seismic phenomena was to be reached through a tolerably close distribution of seismoscopes, with sufficiently accurate clocks, over certain areas which have proved to be

most subject to disturbances from earthquakes. It was thought that this could best be done by the selection and appointment of local directors, each having general charge of the work in a limited area, and through whom persons at once qualified and willing to undertake the care of an instrumental equipment could be best reached. In addition it was thought desirable to organize a large corps of observers, working through the same local directors, who would report observations made without the aid of any special instruments, the system resembling somewhat that for the collection of information regarding thunder-storms, tornadoes, etc., now in use in the signal office and in the New England meteorological society. The questions addressed to such correspondents by the Swiss earthquake commission were discussed, as were also those used by Professor Rockwood in his studies of American seismology during the past fifteen years. The subject of the charting of earthquakes and the graphical representation of results of observation was considered, and a good deal of time was given to the examination of instruments, including one of the seismoscopes of the form recently described in *Science*, and some parts of a seismograph or seismometer now being constructed. Professor Davis reported upon the progress of the work of bibliography which he had undertaken a year ago, showing that much work had been done, and that the result might be ready for publication in the near future. Much confidence was expressed by members of the conference in the success of efforts being made by the geological survey to organize a systematic study of seismology.

The status of the coast survey remains unchanged up to date, although the air is by no means devoid of rumors as to the probable disposition of this, one of the oldest and one of the most efficient of the government scientific bureaus. One of these is that, to some extent at least, its work is to be divided up and transferred to other government services, and it need hardly be said that some anxiety for its future is felt by those who understand and appreciate its past.

The announcement of the resignation of General Eaton as commissioner of education was heard with regret by his many friends here. It is understood that he is to become the president of Marietta college, at Marietta, O. Z.

Washington, D.C., Nov. 30.

ST. PETERSBURG LETTER.

On Nov. 8 the St. Petersburg society of naturalists held its first general meeting of the present winter season. A. N. Krasnow made a communication on the flora of the Kalmuck steppe (on the left bank of the Volga), which he had v this summer with the well-known geol Professor Muschketow. In vol. xvi. of the Pr ings of the society the most lengthy and i tant paper is that on dunes by Sokolow, a geologist, who first studied them near Sestro on the Gulf of Finland, and became then so ested in the matter that he visited dunes c interior in the governments of Kiev and Astra He made interesting observations of the fo the wind, as indicated by an anemometer p but twelve centimetres above the ground. compared these with the size, shape, etc., c sand particles moved by the wind. Observ of that kind, if systematically conducted, m very useful to travellers in permitting the estimate the strength of the wind by the si the objects moved. There is also in this vo a paper on the birds of the White Sea coas Nikolskij. The poverty of the tundra (tr region) of the continent is contrasted with rich bird-life of the seacoasts and islands. two regions are distinguished,— that of the c waters of the White Sea, and of the ocean ea the Swiatoi Noss, rich in individuals, but n species ; and that on the west to the fronti Norway, in waters warmed by the Gulf Str where the species also are more numerous.

The geographical society has had one interes meeting of its section of mathematical and p ical geography, in which Abich lectured on explorations of the Caucasus, his life-work. celebrated geologist has already, for more t five years, retired from active work in the f and lives in Vienna, occupied by the working and publishing of the immense material colle in the Caucasus.

No. 4 of the Isvestia of the society, issued a days ago, is nearly entirely occupied by the liminary report of N. D. Jurgens on the l polar station, and the publication of the det results of the meteorological observations of first year, — Sept. 1, 1882, to August, 1883. daily means of the principal meteorological ments are given, as also the hourly means for e month. The mean monthly temperatures l already been noticed in *Science*. As to the tremes, their relative steadiness is to be mentio The greatest difference between them is 29°.((in December). It is below 24° in January, Ma and April, below 20° in November, and below in July and August. If the limited range in s mer is common to all polar stations, the sam not true in winter, when it is larger, both in N America and in the interior of Russia, but espe ly farther to the east, on the coast of East Sil (Nischnekolymsk, Pitlekaj). The freezing-p

was not reached from October to April inclusive. The daily range is small, as was to be expected, on account of high latitude, position on the sea-coast, and great cloudiness of the warmer weather. The greatest difference of the warmest and coldest hour is 6°.4, in April. The small amount of cloud in winter, and the large amount in the warmer weather, are to be noted. The latter is in great measure due to fog or low clouds. The mean temperature at a depth of 0.4 metre in the ground was much higher in the yearly mean than the mean temperature of the air (—11°.6 against —17°.4). It is interesting to see, thus, how even the small covering of snow mentioned by the observers acts in protecting the ground from the frosts. The relative humidity is great in all months, as was to be expected.

	Extremes of temperature.		Mean pressure.[1]	Amount of cloud.	Prevailing wind.[2]	Mean velocity of wind.[3]
	Min.	Max.				
September	−12.3	11.0	753.9	9.0	W 26	6.7
October	−29.6	−2 5	759.3	7.2	E 25	6.5
November	−36.3	−18.3	758.9	6.0	S 23	5.6
December	−49.2	−19.4	761.7	5.1	S 23	5.3
January	−47.8	−25.9	761.5	3.7	S 28	4.3
February	−53.2	−27.1	764.9	2.6	S 30	5.0
March	−41.6	−18.6	763.9	3.3	S E 24	4.7
April	−32.8	−10.2	765.8	5.2	E 33	5.6
May	−24.2	3.3	755.6	8.6	E 29	6.9
June	−12.6	12.5	752.3	8.4	E 32	6.8
July	−0.2	12.1	757.8	7.6	E 37	8.9
August	−1.2	12.8	756.4	8.5	E 30	7.0
Year	−53.2	12.8	759.3	6.3	.....	6 1

[1] Barometer 4.9 metres above level of river.
[2] The figures show the percentage of the wind to the total number of observations (eight directions).
[3] In metres per second.

A preliminary map, based on the surveys of the expedition, accompanies the report, and gives new and important data, including the northern limit of forest. Generally it reaches to 71° north, but on both banks of the Lena to nearly 72°. The protection afforded by the high ground on the banks of the river is evidently the reason of this; the cold winds of summer, and small amount of sunshine, being the principal enemies of vegetation here, not the winter frosts, which are much more severe in the valleys of the interior, where forest-trees grow well.

At the Moscow university there was, a short time ago, a celebration of the thirty-five years' professorship of N. J. Davydow, one of the most distinguished mathematicians of Russia, his principal works being in theoretical mechanics and the theory of probabilities. Among scientific work going on there, we may mention that published recently by Professor Joukowsky, on the movements of a solid with compartments filled by incompressible liquids.

The Russian universities give their degrees of 'magister' and 'doctor' after a public disputation sustained by the recipient. The latter was recently conferred on I. S. Nasimow, for his dissertation 'On the application of the theory of elliptic functions to the theory of numbers,' — a distinguished work, say the specialists.

At St. Petersburg there was in October a brilliant 'disputation,' after which the doctor degree of chemistry was conferred on Professor Koisowalow, for his work on 'Contact phenomena.' The hero of the day was Professor Mendelejef, one of the official opponents, who made a brilliant speech of more than an hour. On Nov. 15 the degree of magister of astronomy was conferred on Prince Dolgorowsky for his work on 'The secular irregularities in the movement of the moon,' of which our astronomers have a high opinion.

O. E.

St. Petersburg, Nov. 15.

LONDON LETTER.

A DEPLORABLE accident has put an end to the career of one of the most active and useful scientific workers of our day, and has made a gap in scientific circles which will not readily be filled. On the night between Nov. 9 and 10, Dr. W. B. Carpenter, F.R.S., the eminent physiologist, was taking a hot-air bath to relieve rheumatic pains (from which he had more or less constantly suffered since his visit to America in 1882), when by some means the spirit-lamp was upset, and he was so fearfully burned that he died in four hours, in presence of his wife and his two eldest sons. There is good reason to hope that, after the first few minutes of agony, he did not suffer; his last words being, "I have had a good night, I should like to be left alone." The surgeon stated at the inquest that he "had never known so severe a case of burning, it was literally from head to foot." The funeral took place at Highgate, a hill in a northern suburb of London, on Nov. 13. Among those who assembled at the cemetery, notwithstanding the unfavorable weather, were Professor Huxley, the president, and Dr. Michael Foster, the secretary, of the Royal society; Mr. Percy Sladen, secretary of the Linnean society; Professor Judd, representing the Geological society; Professor Stewart, the president of the Microscopic society; Prof. H. N. Moseley of Oxford, representing the officers of the Challenger expedition; Prof. W. H. Flower, of the British museum; Mr. Lecky; Rev. Page Roberts, a well-known representative of the 'Broad church;' Sir Joseph Hooker

of Kew; the Rev. Dr. James Martineau; Dr. Drummond; Professor Upton; Mr. R. Potter; Mr. Talford Ely, secretary of University college; and others well known in scientific circles. In the mortuary chapel, as well as at the grave, the service was read by the Rev. Dr. Sadler, whose ministrations at the Hampstead Unitarian chapel Dr. Carpenter had attended more than forty years. A large number of strangers were present.

During the week frequent notices of Dr. Carpenter's life and work have appeared in the English journals. Born at Exeter in October, 1813, he was the son of Lant Carpenter, a Unitarian minister, and brother of Philip Carpenter, who died at Montreal in 1877, and of Mary Carpenter, the philanthropist, who died at Bristol in the same year. Though probably best known to the world as a biologist, by his books on physiology and on the microscope, his mind was pre-eminently many-sided. As much a man of letters as a man of science, there are proofs enough that, if he were the deftest of compilers, he was also the keenest of 'researchers.' The philosophical character of his mind led him to bestow much thought on higher speculations which might appear insufficiently supported for scientific use; but on these subjects he cherished especially the maxims of Schiller, that the scientific man loves truth better than his system. His services to the cause of scientific education were of the greatest value. For many years one of the first of living teachers, he applied his great knowledge and power of organization to the elaboration of the scheme of lectures in science in the University of London, of which he was registrar for twenty-two years. To the last he remained a member of its senate, and exercised a powerful and most beneficial influence on its deliberations. He leaves to his five sons the heritage of a stainless life, and of a name which, in every land where science is cultivated, will never be mentioned otherwise than with respect.

The [illegible] of the officers and council of the Royal society has just been issued, and contains the following announcements: president, Prof. [illegible] Stokes; treasurer, John Evans; secretaries, Prof. Michael Foster and the Lord Rayleigh; foreign secretary, Prof. A. W. Williamson; other members of council, [illegible]. The vacancies thus created are filled by the election of Lord Rayleigh, who has recently resigned his chair of physics at Cambridge. According to the statutes, of the twenty-one names proposed on the balloting list, eleven must be those of members of the existing council, and ten must be those of fellows not members of that council. The annual meeting is always held on Nov. 30.

November is usually the month of greatest fog in London, and the present year has seen no exception. Of the density of a London fog, few Americans have any idea, except, perhaps, such as live in Pittsburgh, the only place where the present writer, who has travelled much in the United States and Canada, has seen any thing approaching to the smoke-cloud which hangs over our English towns. An entire absence of wind, an atmosphere almost super-saturated with moisture, and the smoke from innumerable household chimneys where bituminous coal is burnt, are the three concurrent causes of town-fog. It was calculated a year or two ago, by Professor Percy and Prof. Chandler Roberts chemist to the metallurgist of the mint, that the amount of solid unburnt fuel which hung in a pall over London (the population of which is, roughly, 4,000,000) amounted to no less than fifty tons. As the late Sir William Siemens pointed out, the true remedy for this state of things is the increased use of gas for fuel.

The various societies are now on the point of commencing their winter meetings. The programme for the next [illegible] session of the Society of arts has just been issued. The chairman of its council, Sir F. Abel, will deliver the opening address on Nov. 13, and the following titles of papers to be read give a fair idea of the scope of the society's operations: Apparatus for the automatic extraction of fine [illegible]-lines of ships: Technical art teaching: Treatment of sewage: Calculating machines: Domestic electric lighting. There are nine sections: [illegible] Foreign and colonial: [illegible] Applied chemistry and physics: [illegible]. — each of which has a monthly meeting. Six courses of lectures under the Cantor bequest will also be given.

The Institute of chemistry held its anniversary meeting on [illegible], the eighth since its incorporation. At the first since it obtained a royal charter. The aim of the Institute is to raise the standard of knowledge required of professional chemists by the examination of candidates for the membership, as a guarantee to the public. [illegible] The president, Mr. [illegible], F.R.S., in the chair.

W.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Newcomb's 'Political economy.'

IN reviewing my 'Political economy' in the last number of *Science*, Prof. E. J. James makes some pertinent remarks about workers in one field trespassing in another. But his method of dealing with such a trespasser is one to be condemned by all lovers of good morals in criticism. It consists, in brief, in misrepresenting his teachings, and putting into his mouth language which he never used, and doctrines and opinions which he never sustained. His misrepresentations are so flagrant, that I feel it necessary to expose them immediately in the journal in which they appeared.

He represents me as undertaking "to bring order into the reigning confusion," and "to give the subject a recognized place among the sciences by being the first to treat and develop it as a science;" putting this pretentious language in quotation-marks in such a way as to make his readers believe that I used it. I used no such language, and made no such pretensions. The first-quoted phrase is, so far as I can determine, entirely of Professor James's fabrication. In the second quotation he has taken a sentence about the possible future development of economics, and altered it so as to change it into a ridiculous claim made by me for my work. What I wrote was, "The author takes a more hopeful view of the future development of economics than that commonly found in current discussion. He holds that nothing is needed to give the subject a recognized place among the sciences, except to treat and develop it as a science."

It will be seen that Professor James takes the sentence from its connection, and interpolates several words in such a way as wholly to change its meaning and application. I shall not trust myself to characterize this proceeding.

The review tends to strengthen the modest hope, expressed in the preface, that the principles laid down would be accepted as forming a well-ascertained, even if limited, body of doctrine. He does not join issue on a single principle of those referred to, but reverses, perverts, or misapplies my views on nearly every principle which he discusses.

I never asserted that "the individual, in following out his own interest, *as he views it*, will, at the same time, *always* promote *in the most efficient manner* the public interest." On the contrary, Book v., § 5, is devoted to showing the error of such a proposition. I have italicized the words in which the misrepresentation consists. Strike out the italicized words, and substitute *as a general rule* for *always*, and we shall have a different proposition, which I sustain.

"But he is trying to get formulas for a general political economy which shall hold good of present, past, and future societies alike," is an atrocious misrepresentation. The proposition in question is one which my book distinctly combats. Section 25 is wholly devoted to showing its error; and, lest the student should forget, he is again warned against it in the summary at the end of the book (p. 539).

He takes a sentence in which I show one of the compensations for the apparent evils of private ownership of land, and comments on it as if it were my main proposition in dealing with the subject. The statement that I confuse the labor party with the socialists is perhaps pardonable as being an impression which a hasty and superficial reader might readily receive, from the fact that, owing to want of space, only certain general ideas common to both could be considered. In fine, there is one, and only one, point in which he correctly reproduces the spirit of my teaching, and joins issue with it; and that is, my conclusion about the practicability of socialistic ideas in the present state of society. This subject, however, is not included in that portion of the book which I hoped would meet with universal acceptance.

I wish it clearly understood that I take no exception to the terms in which Professor James characterizes my work. That my ideas are those of a past generation, and my expressions like a voice from the dead; that I am unacquainted with the recent literature of the subject, and ignorant of actual facts in the social organism, — are views which I not only recognize his right to hold and express, but in the expression of which I admire his frankness. At the same time I do not disguise the fact that it would be very interesting to me to know whether Professor James and his school dissent from any of the principles which I lay down as forming the basis of economic science.

S. NEWCOMB.

Whatever may be thought of the general tenor of Professor James's review of Newcomb's 'Political economy,' there are one or two points in it which simply demand correction. In particular, there is a passage in the first paragraph of the review, the injustice of which can only be set right by citing it in full, and along with it the passage in Professor Newcomb's preface of which it professes to be a quotation. Professor James says, —

"Certain it is, at any rate, that if a man who had given the best years of his life to the study of political economy should wander over into the field of astronomy and physics, and undertake 'to bring order into the reigning confusion,' and 'to give the subject a recognized place among the sciences *by being the first* to treat and develop it as a science,' Professor Newcomb would be just the man to administer a severe and deserved castigation."

The paragraph in Professor Newcomb's preface upon which this charge of outrageous pretension is based is the following: —

"The author takes a more hopeful view of the future development of economics than that commonly found in current discussion. He holds that nothing is needed to give the subject a recognized place among the sciences, except to treat and develop it as a science. Of course, this can be done only by men trained in the work of scientific research, and at the same time conscious of the psychological basis on which economic doctrine must rest. To such investigators a most interesting and hopeful field of research is opened in the study of the laws growing out of the societary circulation. If the same amount and kind of research which have been applied to the development of the laws of electricity were applied to this subject, there is every reason to suppose that it would either settle many questions now in dispute, or would at least show how they were to be settled."

Of course, no one would charge Professor James with purposely inserting the words we have italicized, and thus completely altering the meaning of his quotation; but no one can read the paragraph in

Newcomb's preface without seeing the gross and unpardonable carelessness of a reviewer who would interpret it as Professor James did, not to speak of the additional carelessness in writing which led him to so misquote Newcomb's words as to make them explicitly convey the meaning he had falsely assigned to them.

Somewhat more pardonable — if due to ignorance on Professor James's part — is his speaking of Professor Newcomb as 'wandering over into the economic field' at an advanced period in his life. Most people in this country who are interested in economics know that Professor Newcomb has been a student and writer upon economics for the last twenty-five years or more. If Professor James knew this, — however low might be his opinion of the result of Professor Newcomb's studies, — his speaking of Newcomb's 'wandering over into the economic field' is simply inexcusable misrepresentation.

Professor James goes on to say that "there is no evidence in the style of reasoning in this work that the author is at all acquainted with the recent literature of the science either in England or on the continent. One great advance in economic science in the last twenty five years lies in a change of its prevailing method." I, for my part, do not know to what extent Professor Newcomb may be acquainted with the writings of the recent German economists or their English-speaking followers; but, so far as the absence of any effect of their work upon his method of discussion is relied upon as evidence on this head, it is very pertinent to ask Professor James how much of the influence of these writers is discernible in Professor Sidgwick's recent work on political economy. Professor Sidgwick, being unfortunately 'professor in moral and political philosophy,' may be regarded by Professor James as not quite enough a specialist to be cited; but we have his own word for it (in his preface) that, "among foreign writers," he had "derived most assistance from the works of Professors A. Held and Wagner;" and in spite of his having seen the new light, his book professes to be in the main a guarded restatement of the principles of the old masters.

This is not the place to enter into a general discussion of the merits of the new economists who think they have 'exploded' every principle of political economy from which they can show that an erroneous practical conclusion has been drawn, and who freely distribute such adjectives as 'crude,' 'dogmatic,' and 'mazy,' in speaking of any theory which they find has not taken note of every disturbing influence. But it is presumptuous in a member of this school to regard a general adherence to the methods of Mill and Cairnes as evidence of ignorance or incompetence.

It would take too long to show how unfair is Professor James's presentation of Newcomb's treatment of *laissez-faire*. I trust that the correction I made at the beginning of this letter may be enough to render the reader somewhat suspicious of Professor James's fairness and accuracy in representing his author. It may, however, be worth while to re-enforce this suspicion by observing that the last sentence in Professor James's article is entirely and absurdly gratuitous, as Professor Newcomb, in speaking (p. 153) of the government's assuming (an unfortunately chosen expression, I admit) that "the values of equal weights of the two metals have a certain fixed ratio to each other," is simply engaged in *describing* what governments do when they establish an unlimited bimetallic system; his discussion of the 'views' both of m metallists and of bimetallists being reserved subsequent portion of the book (which Pro James would seem not to have read) in whi criticises the arguments on both sides without de in favor of either. Fabian Frank

Baltimore, Nov. 27.

The Biela meteors.

The Bielid meteors were observed here in co able numbers last evening. I am sorry to say, having been very busily occupied all day, I had forgotten that they were expected, and so w on the lookout for them at the beginning o darkness. I suppose that in consequence I pro missed the maximum of the shower, which se have occurred very early in the evening.

On going out of my house at 7.15, my att was immediately attracted by seeing two mete the sky together, followed almost instantly by o While walking the first hundred yards, I twelve; and during the whole ten minutes' to the Halsted observatory, I counted thirty though the eye was much disturbed by the s lights, and though for a considerable part of the the view of the sky was more or less obstruct trees and buildings. The shower was apparent the wane, however, and the number per m diminished pretty regularly. Up to 7.45, abou hundred had been recorded in all; between time and 8 o'clock, only three or four more seen, and observation was discontinued.

About half a dozen of the hundred were as b as stars of the first magnitude; about fifty we the second and third magnitudes; and of th mainder a considerable proportion were betwee fifth and sixth magnitudes, just fairly visib the naked eye, and only seen when one happen be looking at the exact place where they appe Of course, it is likely that the real number of faint meteors was much larger in proportion t brighter ones than the actual observations wou dicate. Several of the larger ones left trains lasted for two or three seconds, never more were always red. In no case was the meteor, train, of the greenish or bluish tinge which ch terizes the Leonids. The tracks were very f them more than 10° or 15° long, and the motio rather slow for a shooting star, the duration of being usually more than a second, even whe path was not more than 5° long. In a few cas tracks were decidedly curved or crooked.

The 'radiant' was very well marked, — an o gion about 4° long, north and south, and ab wide. Its centre, according to the best estim could form, was about 2° north-west from G Andromedae, A.R. $1^h\ 50^m$, $\delta\ 43°.5$. The deter tion rests largely upon three nearly stationa teors, with tracks not exceeding 15° in length, appeared within the limits of the radiant; agrees satisfactorily with the result obtain plotting fifteen or twenty other tracks in the part of the sky.

It would seem from this that the radiant is a little farther east than it was in 1872, when, a ing to A. S. Herschel (*Monthly notices*, vol. p. 78), its position was A.R. $1^h\ 41^m.6$ ($25°.4$) and In 1872 some of the best observers found evi of two or more distinct radiants. Nothing

kind is indicated by any observations last night, though a few of the meteor tracks (perhaps five or six in all) would not pass strictly through the radiant if traced back. C. A. YOUNG.

Princeton, N.J., Nov. 28.

A bright meteor.

On Friday, Nov. 13, about 10.30 A.M., the attention of a number of our students was attracted by a brilliant meteor.

The appearance as described by Mr. H. Toulmin, of the senior class, is as follows: The path of the meteor began 15° or 20° west and north of the zenith, following a north-westerly direction, and ending some 20° from the horizon.

The brightness he compares to that of Venus when seen at night. The sun was shining brightly, and no clouds were noticed. No explosion was heard, nor did any fragments seem to reach the ground.

C. L. DOOLITTLE.

Lehigh university.

Absorption of mercurial vapor by soils.

Last year considerable attention was excited by the proposition to utilize the insecticide properties of mercurial vapor against the phylloxera or vine-louse. This suggestion originated with Mr. J. A. Bauer, a druggist of San Francisco, and himself the owner of a vineyard in the infested region of the Napa valley, where he had for some years experimented on the efficacy of mercury, and satisfied himself of its usefulness as a preventive of infection, when, in planting, each cutting was surrounded by a few inches of earth mixed with 'deadened' mercury. Upon publication of the fact, a considerable demand for the mercurial mixture (consisting of equal parts of finely divided mercury and clay or chalk) was made by persons interested, and many thousand vines were treated in different localities in the manner prescribed by Mr. Bauer. This was to mix thoroughly about a peck of earth with an ounce of the above mixture, and fill in with it the hole in which the cutting has been placed, to the depth of at least six inches from the surface. Many experiments were also made on vines already infested, to see if the mercury would gradually spread so as to disinfect the whole of the root system.

Contrary to expectation, most of these experiments proved a failure, inasmuch as the phylloxera seemed to continue, unchecked, on the roots already infested, and in some cases clean cuttings had become infested, despite the surrounding mercurialized soil.

Having witnessed a number of the successful experiments upon which Mr. Bauer's recommendations were based, I undertook an investigation of the circumstances of the reported failures, and soon discovered two that were essential. One was that the mercury used was considerably contaminated with lead, which is known to diminish exceedingly the evaporation of mercury; another, that oil had been used in order to facilitate the 'deadening' process, and thus each globule was covered with a film that additionally impeded volatilization. In fact, the iodine test for mercurial vapor showed that a mere trace of the latter existed around the mixture furnished by Mr. Bauer, while a similar one prepared with pure mercury showed abundant volatilization at the ordinary temperature, and acted very promptly upon insects.

Yet, upon using the latter mixture in the manner prescribed by Mr. Bauer, in a very clayey soil, neither the insects nor the iodine test manifested the presence of mercurial vapor. It was now remembered that Mr. Bauer's successful experiments had been made in a very sandy soil of the city of San Francisco; and the inference was plain, that, just as aqueous vapor would be absorbed to a much greater extent by a clay soil than by sand, so the mercurial vapor was at first absorbed by the former until saturation was reached, which might not be for many weeks or even months; the soil acting as an effectual disinfectant until supersaturated.

Experiments proved this surmise to be correct; and the investigation, still in progress, seems to show that the capacity of soils for the absorption of aqueous vapor may serve as an approximate measure of their relative capacity for the absorption of mercurial vapor also. Thus in pure sand, which in a saturated atmosphere at 15° C. absorbed only .5 per cent of aqueous vapor, the amount of mercurial vapor absorbed was too small for analytical determination; while in a clay soil, absorbing, under the same conditions, 6 per cent of watery vapor, the mercurial vapor retained at 49° C. amounted to .012 per cent, equivalent to about 130 grains per cubic foot of soil. Now, since from one-fourth to one-half cubic foot was used in the treatment of vines, it follows that from 33 to 65 grains of metal out of the 240 used in each case, would have to evaporate and impregnate the soil, before any free vapor would be available for action on the insects. At the low temperature of the soil this would naturally take a considerable length of time: hence the failures.

It is of course perfectly feasible to insure this impregnation beforehand by exposing the mercurialized soil to a higher temperature (e.g., to that of 49° C., easily attained in California by exposure to the sun) for ten or twelve hours, or for a much shorter time to steam-heat. A clay soil so prepared will act on the phylloxera as promptly as when sand is used; all being dead, or incurably poisoned, within from 20 to 30 hours.

The method is therefore far from being a failure, as has been industriously represented by interested parties. It will accomplish all that has ever been claimed for it; to wit, the preservation of young vineyards from infection through the ingress of the phylloxera from above; and, as there is no occasion for disturbing the earth immediately surrounding the stock of a vine, there is no reason why this protection should not continue for all the time the vine is likely to live. With proper precautions, it will also, no doubt, be available against other insect pests of similar habits; e.g., the 'woolly aphis' (Schizoneura lanicera Hausm.) The conditions for successful application in practice in various cases are still under investigation. E. W. HILGARD.

Agric. exper. station, Berkeley, Cal., Nov. 23.

The English sparrow.

Your correspondent in *Science*, No. 147, asks for information in regard to the English sparrows. In this city (Cincinnati) and vicinity there are large numbers of these birds, and local ornithologists have no hesitation in saying they drive away the native songsters.

At my house, in one of the thinly populated suburbs,

they were abundant during the summer. A patch of woods close by harbored many native birds which occasionally strayed into trees near the house. As soon as one of these ventured to alight on a branch, the sparrows would desert the eaves of the house and settle on the tree, and there they would chirp and chatter till the other bird was literally driven away. Robins and flickers were greatly annoyed, but the cat-bird flirted his tail in disdain, and seemed to be the only one which could not be driven away.

As for their insectivorous habits, I have been informed by Mr. Charles Dury that he has dissected forty or fifty of the birds which were shot at different times and places during two years. In none of these, with but a solitary exception, did he find a trace of the remains of an insect. Every one was filled with seeds of one sort or another; and he concluded the insect had been picked up and swallowed by mistake. Still, it would appear that numbers of cicadas were killed, though not eaten by the birds, here as well as in Washington.

As far as the extermination of the sparrow goes, it does not seem a difficult task. Let the laws protecting it be repealed. Let a bounty be offered for every scalp, and free permission to kill whenever and wherever found would tend to rapidly diminish the number of the pests. The increase in number is largely due to the protection afforded by law, and by the sentiment of people. If wolves, bears, and panthers can be exterminated by the means above spoken of, there seems little reason to say that the same result would not follow with the sparrow.

Jos. F. James.

Cincinnati, Nov. 27.

I would like to give some information in regard to the habits of the English sparrows, which I hope will soon be stamped as outlaws, and a price put on their heads, like unto those of all marauders.

They not only drive away our native birds, but are the worst enemies of the fruit-grower and gardener. They are not scavengers, but, on the contrary, by their habits become defilers of human dwellings and water. I will give such facts as came to my notice during many years of observation at my home in Hudson county, N.J., which will substantiate the above assertions.

We had provided numerous boxes for nests for bluebirds and wrens in the trees, and before the introduction of the English sparrows in New York, in 1864, these were invariably occupied by the same family each spring: additional nests were always soon occupied. Any one acquainted with these pretty little singers will understand the peculiar charm they lend to a country home. During the summer-time the grove would be full of thrushes, who would build their nests in the underbrush, and fill the morning and evening air with their melodious song.

Within four years after the introduction of English sparrows, they had found their way to our home, and immediately began harassing the bluebirds, sometimes destroying their nests. As soon as we noticed this, we took the part of our pets the bluebirds, and would fight the sparrows at every point. This was soon noticed by the bluebirds; and it actually happened, that, when hard pressed by the sparrows, they would fly close to the house, to attract our attention to their trouble by plaintive cries. We succeeded in protecting them for a few years; but, with the rapid increase of the sparrows, the bluebirds have left their former abodes, never to return to them except as travellers.

When we noticed that the wrens were harassed in a similar manner, we made the entrance holes to the boxes so small that sparrows could no longer enter. We then found that the sparrows would take turns about sitting on the perch in front of the opening until the old wrens had left, or until the young ones were starved. In two cases we found that old wrens had been kept imprisoned until starved to death by the sparrows preventing their exit. We did all we could to drive them off, — shot them with guns, caught them in traps, destroyed their nests, etc.; but all in vain. They learned to recognize a gun, and, as they always have guards in a flock, a signal from a guard would scatter them to the winds instantly. They could only be caught in traps for but a short time, when again they would become acquainted with them, and avoid them. The best way to drive them away seems to be to destroy their nests without tiring; then they will partly leave. They would fight the brown thrush, and scatter its eggs, whenever opportunity presented itself, and seemed to take particular delight in pulling the nests to pieces to build their own with the *debris*.

In spring they destroy the strawberries, to begin with, and attack every variety of fruit, except currants, gooseberries, and apples. They do not feed on cherries to make their living, like native birds, but merely take a bite of each berry, and destroy it wantonly. When pears are ripe, they will peck large holes in them to drink the juice. They generally appropriate half our vineyard, and cannot be frightened by scarecrows. They invariably keep themselves busy, when not hungry, by picking off young sprouts, especially of fine plants and rose-bushes, but do not spare trees. It seems that they do this merely to keep themselves busy. In addition to the above, they do not destroy worms which build a web, although they probably destroy chrysalides or open cocoons in winter-time, when they can find no other food. We have never seen them destroy worms in summer-time, when other food is abundant.

G. C. Henning.

Louisville, Ky., Nov. 27.

A new variable.

As an item of interest for your astronomical notes, I send the following: —

I have discovered the star D.M. +27,3890, to be a variable of the η Aquilae type.

A preliminary reduction of the observations so far obtained, from which a light curve has been formed, indicates strongly that the period will not vary much from four and a half days. The approximate limits of fluctuation I find to be from 5.6 to 6.7 mag. The position of the star for 1855.0 is R.A. $20^h\ 45^m\ 19^s.4$; decl. $+27°\ 42'.3$.

The star is likely to prove an interesting one, owing to its short period, there being only three known variables of this type with shorter periods.

The variability and character of the light changes have been confirmed by Mr. S. C. Chandler, jun., of the Harvard college observatory.

Edwin F. Sawyer.

Cambridgeport, Mass., Nov. 30.

SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 4, 1885.

ELECTIVE STUDIES AT HARVARD.[1]

A NEW departure has been made in Harvard college during the past year, in that, for the first time in its history, freshmen have been allowed to choose a majority of their studies. Under the new rules but seven-sixteenths of the work of the freshman year will be prescribed: the rest of the college course, excepting a few exercises in English composition, will be elective.

Let us examine on what facts the Harvard faculty build their confidence in the elective system; in what sense it can be called a system; whether, furthermore, its introduction, while making instruction more agreeable, does not tend to lower its standard; and, last, whether its tendency is to foster character, and to make vigorous and law-revering men.

A preliminary objection is that the so-called system is really no system at all, but a mere cutting of straps. This is a misconception. The student under it merely chooses the specific topic of his study: what the amount of it shall be, and what its grade of excellence, are decided for him. After completing his freshman year, the Harvard student must pass successfully four elective courses in each of the following three years; and in each course or single line of study 50 per cent of a maximum mark are required each year for a pass. After his first year, then, the Harvard B.A. must have prosecuted twelve courses of self-selected studies, and mastered them at least half perfectly.

The essence, then, of the elective system, is fixed quantity and quality of study, but variable topic. Every important New England college admits it, to a certain extent, in both senior and junior years, while some allow it in the sophomore. In Harvard its adoption has been very gradual. In 1825 options were first allowed in modern languages. Years of experiment followed, with the result that the old method was step by step abandoned. The time of transition has been one of great prosperity. During the past fifteen years the gifts to the university have averaged $250,000 a year, and the number of students has steadily increased; the average attendance of undergraduates during the five-year period 1861 to 1865 amounting to only 423, while that during 1881 to 1885 reached a total of 873.

Harvard, then, has become prosperous by taking the lead in a great educational movement, the necessity for which lay in the fact that of late years the field of knowledge has so greatly widened. A place on the college curriculum has had to be found for modern languages, political economy, and science in its various departments. To avoid the danger of superficiality, — which is opposed to thorough-going discipline and the acquirement of sound mental habits of thought, — a choice was necessary between so many different subjects. In making this, too, personal aptitudes had to be considered, and thus a new principle was introduced; viz., that of valuing studies less according to their subject-matter than according to their fitness for the mind of the student. The will came to be treated as of primary importance. The student is told at Harvard, 'Study what you will, but you must will to study something.' The boy is thus taught how to choose during the formative period of his life, that is, between the ages of eighteen and twenty-two.

A manlier type of character is actually observed as the elective principle extends. The students show an enthusiasm for their work that was lacking formerly. Their ideal of a 'gentleman' is now higher than it was; and hazing, window-smashing, and disturbing a lecture-room, are now things of the past. That a decent scholarship has now become reputable, may be seen from the fact that in the last senior year 91 out of 191 men received 'honorable mention;' i.e., took a high rank in three or more courses of a single department. The following table, which gives the average percentage of marks attained at examinations during the past ten years shows that the standard of good scholarship has been steadily rising.

Year.	1874-1875	1875-1876	1876-1877	1877-1878	1878-1879	1879-1880	1880-1881	1881-1882	1882-1883	1883-1884
Freshman.....	59	55	5	56	62	62	65	67	64	63
Sophomore....	5	64	63	65	67	68	70	69	69	68
Junior.....	67	65	66	67	70	68	72	75	72	72
Senior.....	67	70	70	73	76	73	77	75	79	81

Observe that the marks become higher on approaching the senior years, where the elective principle most prevails, and that while, in 1874, one-half of the freshmen who were doomed to

[1] Abstract of Professor Palmer's article on Elective studies at Harvard university, *Andover review*.

prescribed studies gained less than 60 per cent, ten years later one-half of the seniors obtained four-fifths of a perfect mark in four electives.

Two objections may here be raised; viz., that the selected courses will have but little connection with each other, and that the easiest ones will always be the favorites. An answer to the first objection is contained in the fact that nearly one-half of the last senior class chose at least three closely related courses. The charge of 'soft' courses is the stock objection to the elective system, and seems, *a priori*, a sound one. The subjoined list of the courses which in 1883–84 were most largely attended by seniors and juniors, shows that, when choice gets full play, the factor of interest may make a severe study popular.

The courses were: Mill's political economy, 125 seniors and juniors; later European history, 102; history of ancient art, 80; comparative zoölogy, 58; political and constitutional history of the United States, 56; psychology, 52; geology, 47; constitutional government of England and the United States, 45. Are not these studies just those which should be the most popular?

It may be asked how such wise selections are secured, and we answer, simply by making them deliberate. In June the students must choose their studies for the next year, and notify the dean of their choice. Until Sept. 21, any elective may be changed, on notice sent to the dean. During the first ten days of the term no changes are allowed, but afterwards for a short time they are easily effected. For the remainder of the year no change is possible, except for urgent reasons.

By these means the faculty tries to avoid waste of time over unprofitable studies. Of course, not seldom unwise choices are made; but is not that true to an even greater extent in the case of prescribed studies? Moreover, the wastes of prescription affect chiefly the energetic and original students, while under the elective system it is especially the shiftless and dull who suffer, that is, men who cannot be much harmed by any system.

Then, how much the instruction under the two systems differs! When studies are prescribed, the teaching becomes often a secondary affair, and the pupils have to be urged to work. Under the elective system the student feels that he has something at stake, and a higher style of teaching becomes possible. Theses are read, and original works consulted. During 1860–61 only 56 per cent of the Harvard undergraduates consulted the college library; during 1883–84, 85 per cent.

Then, again, under the new system at Harvard, attendance at lectures is not compulsory; *though*, of course, a lengthened absence would not be permitted. The results obtained trusting the students have been satisfactory the last senior class the total absences, wh from sickness, misdeeds, or other causes, amo to but 16 per cent of the total number of r tions. Colleges requiring attendance seldom better results.

But when studies are elective, professor benefited equally with students. Teache taught are brought closer together, a cor sympathy animating both alike. The prof too, gets to see himself as others see him, a inefficient, his class soon dwindles away. professors and students are, in fact, put on good behavior.

But why introduce the elective system so as the freshman year? First, because the of eighteen needs just such a happy influen his character as the system gives; second, be the loss of time incident to learning to choos best be borne in the earlier, that is, least val college years; while, last, the change from s to character methods is too important to be m by the mere passage from one class to an A change of residence should mark it. A ch ter-college, then, while no place for the ind rich, is best suited for the democratic man whom the elective system gives an opportunit mental and moral expansion which no compu system can afford.

We must, however, remind the reader tha system is not yet perfected, and has still man perfections. Convinced, as we are, of the s ness of its method, we invite criticism, which sl now turn to the important work of betterin details of operation.

ENSILAGE IN ENGLAND.

In a return to the house of commons, en 'Ensilage commission, evidence, part i., Pr nary report and minutes of evidence,' and 'Return of the replies to questions relating t and ensilage put by the agricultural depart privy council,' which have lately reached u latest information is contained in regard t views held in Great Britain as to the value o and ensilage, and the practical successes experiences with this still somewhat experin method of preserving and feeding various of green food to stock, in an undried conditi

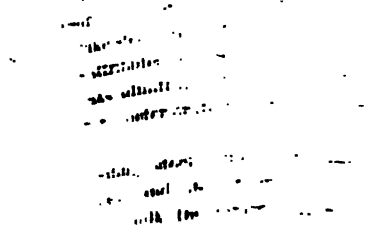
The evidence obtained voluntarily by th liamentary commission from thirty-eight witn including Sir John B. Lawes, Viscount De zelles, and the owners and occupants of large estates, their agents and tenants, an inventors of different forms of silos, not excl

any testimony of an unfavorable nature, but endeavoring to induce persons believed to be opposed to the system to give their opinion, has in their opinion, without exception, established the claims of the system to a considerable amount of success; and, although in some cases the results have been evidently more satisfactory than in others, nevertheless, all the systems seem to show that a nourishing, useful food for animals can be preserved, independently of any drying process, within wide lines of divergence in the details of the methods adopted. Different degrees of weighting and of exclusion of atmospheric air are the causes of different degrees of heat, and of consequent chemical change produced. It is apparently, as yet, largely a matter of opinion whether such chemical changes increase or diminish the feeding value of the ensilage, or its relative value in comparison to the green crop. The solution of this question the commissioners naturally regard as of great importance, and consider that careful feeding experiments, conducted with a view to test the exact effect of these changes, are very desirable. They find that whether the ensilage has been covered in immediately after cutting, or put in at intervals, the air not being immediately excluded and considerable heat developed, yet in both cases a useful feeding material has been obtained which would have been lost if any attempt had been made to convert it to hay in unfavorable weather.

As to the economy of different systems of making and storing ensilage, the commission is not prepared to express an opinion; nor does it desire at present to compare the advantages of different systems, the quality of the ensilage being not materially affected thereby. Special circumstances affecting particular localities must influence and regulate the methods employed. It was found that some of the best ensilage was produced with a pressure of not more than seventy pounds per square foot, but the degree to which weighting is necessary or desirable remains to be decided. Good results are claimed with weights between seven and three hundred pounds. Evidence shows that all differences in actual results, not dependent on composition of food-plants employed, are traceable to the variations in the degree to which fermentation is allowed to be set up in the silo, and the length of time it is continued. The fermentation, too, is controlled by or dependent on the manner of constructing, filling, covering, and weighting.

The testimony of the dairy farmers does not appear to justify the assertion, which has been circulated, that dairy products are [illegible] on the contrary, there is much valuable evidence to show that well-made ensilage distinctly improves the yield of milk and cream, and the quality of the butter. This is of interest on this side of the water, as a similar report has gained ground here, without, as far as has been learned from our investigations, any reason, unless the ensilage is fed too soon after coming from the silo. It should be exposed, at least in the case of sour maize ensilage, for a period of twenty-four hours to remove an odor which sometimes affects the milk when the feed is fresh. Tainting of the milk, the commission considers to have been due in many cases to proximity to strong-smelling ensilage after milking. The report concludes by saying that they have heard sufficient evidence to warrant the extension and development of the system as a valuable auxiliary to the farm.

The second part of the report of the commission, soon to appear, will contain the documentary evidence obtained in answer to twenty-five practical questions sent to the proprietors of silos in various parts of the kingdom. We have before us the answers to similar questions sent out by the agricultural department, privy council, which have been published in the second report which has been alluded to, in much the same way as was done by the U. S. department of agriculture two years ago. From the summary of the replies, we learn that the silos in Great Britain have doubled in number in the space of twelve months, that they vary in capacity from 96 to 55,440 cubic feet, averaging 2,801, and that they are built both with and without provision for drainage, but largely without. Drainage, it is suggested, requires care to prevent admission of air, and, we would add, loss of nutrients when the pressure is not properly regulated. The construction of the silos varies in material and location according to the locality where they are built. Any material furnishing the absolute requisite of rendering the walls air-tight seems suitable and successful, and localities where there is sufficient difference to enable the filling to be done at one level, and the drawing-out at a lower one, seem to be most favorable. Oats, green barley and wheat, maize, buckwheat, sanfoin, rye and all sorts of grasses, hop-vine, turnip tops, peas and beans, with mowings from hedges, and fences, and ditches, including nettles, sedges, and rushes, have all been more or less successfully made into palatable ensilage. The addition of salt was mentioned unfavorably in many reports, as was the case with the testimony before the parliamentary commission. The methods of compression have varied very much, but dead weight has been largely employed, and water-tanks so arranged as to be air-



there can now be scarcely any doubt, if the sum of the aggregate result of the replies recorded may be taken as a guide. The system hitherto may be said to have been somewhat tentative; but, if the rate of development shown in the past year continue, it appears probable that it will be far-reaching in its effect.

The system is undoubtedly peculiarly adapted to the moist climate of England; and the success there met with, in connection with past experience of a somewhat longer and wider range in this country, certainly points to a future which will make this method of feeding stock of the greatest value to the stock and dairy farmer. The evidence of the British farmer is of particular interest, in regard to a new system of this sort, as, from his habits of intensive farming, he is perhaps more qualified to judge of it than his American fellow-laborer.

THE PANAMA CANAL.

THERE is no engineering enterprise now in progress which has excited more general interest, or the successful completion of which will affect more deeply the concerns of the commercial nations of the world than the Panama canal. As work was begun in 1880, or perhaps more accurately in 1881, and as the completion of the undertaking was promised for 1888, it is quite time to inquire what progress has been made up to the present date, and what is the prospect for the future. The book of Mr. J. C. Rodrigues,[1] which is a reprint of a series of articles written for the London *Financial news*, gives a summary of the operations from the beginning until now, with his opinion of the condition of the company, the political bearing of enterprise as regards the United States, and the impending catastrophe. It deserves a careful perusal by every thoughtful citizen, and presents a more concise, and at the same time comprehensive statement of the case than has as yet appeared.

After a brief survey of preceding explorations of the isthmus, he gives an account of the expeditions of Commander Lucien Napoleon Bonaparte Wyse, of the French navy, and of the concession he obtained from the United States of Columbia, in 1878, for a canal at the Isthmus of Panama. In 1879 the 'International scientific congress,' as it was called, at Paris, under the auspices of M. Ferdinand de Lesseps, decided to recommend the construction of a ship canal at the Isthmus of Panama, to be built without locks and as an open cut from ocean to ocean. Those American delegates to the congress who were well fitted to judge of the facts from personal examinations, or reports of surveys at Darien, Tehuantepec, Panama, and Nicaragua, and other delegates qualified by practical experience, opposed in vain this decision, pointing out the difficulties and uncertain quantities which rendered a wise judgment and a reliable estimate impossible at that time, and urging the advantages of other sites. The enterprise, however, was to be carried on by Frenchmen; the assistance of M. de Lesseps was assured; and his success in carrying through the Suez canal, a far different undertaking in character of materials and obstacles to be overcome, was pointed to as an answer to all objections. The intention appeared to be to forestall any work which others might undertake at points which have been and still are regarded as much more favorable.

The canal congress estimated the cost of a sea-level canal at 700,000,000 francs, or £28,000,000, although a sub-committee had practically put the cost at 1,040,000,000 francs, and added that the "execution of such works, and principally that of such deep cuts, the stability of which is problematical, as well as the operations relating to the course of the river Chagres, constitute a complication of difficulties that it is impossible to estimate." There was added to the prime cost 25 per cent for unforeseen expenses, 5 per cent for expenses of banking and administration, and 3 per cent per year for interest during construction. An 'international commission' visited the isthmus in 1880, and reported that the canal would cost 843,000,000 francs, without preliminary, banking, and administrative expenses, and interest during construction, and estimating contingencies at but 10 per cent. They reported 75,000,000 cubic metres to be excavated, in place of 46,000,000 previously estimated. This estimate of cost M. de Lesseps first cut down to 658,000,000 francs, and later to 530,000,000 francs. A more extended acquaintance with the problem has raised the estimate of quantity to 125,000,000 cubic metres.

The dredging through the low alluvial lands near the sea, and the formation of harbor works, would, of course, present no difficulty; but the two rock-cuttings — the deepest at the Culebra, 820 feet in width at the top, containing from 25,000,000 to 30,000,000 cubic metres, of which but a small portion has yet been removed; and the Emperador cut, not so deep, but containing about the same quantity of rock — are very formidable obstacles, which will, at the rate work has as yet progressed, require many years to overcome. There is also the uncertainty whether little or much water will be encountered in the lower portions of these cuts. The removal of rock under water will swell the cost greatly.

[1] *The Panama canal: its history, its political aspects, and financial difficulties.* By J. C. RODRIGUES. New York, Scribner, 1885.

The Rio Grande and Rio Obispo cross the canal eleven and seventeen times respectively, and hence must be diverted, calling for thirty miles of new channels. The most formidable obstacle, however, and one which leads many engineers to doubt the possibility of the maintenance, if not the construction, of the canal, is the controlling of the tremendous floods of the upper Chagres, — a stream which, in the dry season, has a depth of but two feet, but which, in the rainy season, becomes a raging mountain torrent, rising sometimes in a few hours to a height of forty feet, and sweeping down immense quantities of *débris*. The projected line of the canal is first crossed by it at Gamboa, at an elevation of about fifty feet above the bottom of the canal; from Gamboa to the sea the canal is crossed by it twenty-nine times. It is evident that some most substantial and expensive works are needed to restrain or divert the flood waters of the Chagres, or the canal will be ruined by its irruption. An immense dam of masonry or earth, or of both materials, has been proposed, near Gamboa, a mile in length and from 150 to 200 feet high at its highest point, to impound and store up the flood in an artificial lake, from which it shall escape more gradually through sluices and channels provided for the purpose. The storage capacity of this reservoir is estimated at 6,000,000,000 cubic metres, which is not too much for a watershed on which a depth of five and one-half inches of rain has been known to fall in four and one-half hours. The occurrence of a second tropical rain, before the first has had time to drain away, might be disastrous. This difficult problem, which was pointed out and dwelt upon by some of the delegates to the congress, but was apparently passed lightly over by the majority, seems still to be unsolved at the hands of the French engineers, although the completion of its study has been promised from year to year.

The Panama railroad was purchased by the canal company; dwellings, hospitals, and workshops were erected; dredges, machinery, and tools were procured; and excavating was begun. Considerable earth and some rock have been removed. Rapid progress has been promised from time to time, but has not been attained; 2,000,000 cubic metres per month were hoped for, but 800,000 cubic metres have not been removed in any one month, and from 1881 up to May, 1885, the amount was only 12,376,000 cubic metres. The amount of material to be moved was first placed at 46,000,000 cubic metres, then 75,000,000 cubic metres, has now swelled to 125,000,000 cubic metres, and good judges believe this quantity to be much too low. M. de Lesseps has raised amounts as follows: 50 per cent on the shares of the company, 147,500,000 francs; loan of 1882, 125,000,000 francs: loan of 1883, 300,000,000 francs; and loan of 1884, 193,692,500 francs; making, in all, 766,192,500 francs. He has now applied to the French government for permission to issue new canal bonds to the amount of 600,000,000 francs, and proposes to call to his aid a lottery. A further call on the shareholders is also to be made. Discount and interest charges will amount to a formidable sum. One observer puts the time required to finish the canal at six years, another at twelve, and still others at twenty and even fifty years. Mr. Rodrigues fortifies his statements by citations from official documents, and from reports of U. S. officers and others, who have repeatedly inspected the progress of the work. He does not hesitate to predict the failure and bankruptcy of the present company within a short time.

The author devotes considerable space to the political aspects of the question, the stand which the United States has taken in the matter, the Monroe doctrine and the Clayton-Bulwer treaty, and the serious complications which may ensue if the French government shall take up officially the enterprise upon the failure of the canal company. The chapters given to the discussion of these topics are of great interest; but space will not allow a review of them here, even if it was appropriate for these pages.

HYPNOTISM.

PSYCHOLOGY is the last of the sciences to pass from the popular and literary stage to the technical. Time was when physics and chemistry were discovering facts of so flagrant and fundamental a nature, that fine ladies could be startled and entertained by accounts of them at dinner-parties. We have seen, in the last decade, biology present, in the Darwinian theory, what probably will be its last popularly interesting conception, and then plunge into such a labyrinth of embryological and other technicalities as only dry specialists can tread with her. Psychology even now trembles on the brink. Some departments are already quite intractable to literary handling: space perception, the measurements of various discriminations, and those of the time required by elementary mental processes, for example. But still much remains in psychology for the amateur of our generation to enjoy, and it is not yet impossible for treatises with some literary flavor to be written in that science. But the time is short; we seem on the verge of fundamental discoveries, and when they are made we must bid adieu to the simple charm, the easily verified facts. Work will be carried on

in a thicket in whose darkness only technically trained eyes will feel at home.

Hypnotism now stands where gravitation, galvanism, and the 'metamorphosis of plants' once stood. In France, especially, a real *fureur* of investigation is going on, and all sorts of people are trying their hand as magnetizers or as subjects. Repeatedly assailing the academies for recognition, as repeatedly rejected by reporting committees, whose criticism occupied itself too much with a few exceptional claims, and too little with the fundamental conditions of the hypnotic state, this latter at last wears official robes; and it is as 'bad form' now to be ignorant of its phenomena as a while ago it was to know any thing about them. To those who would no longer remain ignorant, Dr. Cullerre's little compilation[1] may cordially be recommended as the work of one who has tried to survey the whole ground, and who has certainly brought a great deal of scattered material together, and put it into readable shape. There is no other account of the subject at once so short and so complete. More than this we need not say of the book, for it makes no pretensions to originality, and the author's own critical comments are so rare, that a certain intellectual commonness about them may well be overlooked.

As matters now stand, the fundamental phenomena, sleep, narrowing of the field of consciousness, blotting out of memory, insensibility or hyperaesthesia, modifications of neuro-muscular irritability, hallucination in obedience to suggestion, etc., etc., are too *banals* to excite any longer much interest; and the attention of investigators is directed more and more to the *curiosities* of the hypnotic state, to those exceptional phenomena belonging to the individual subjects from which (by virtue of the law that nature shows us her secrets most readily in her monstrosities) most may be hoped for in the way of light thrown upon what is, after all, a great mystery.

Foremost among these novelties are the 'post-hypnotic impulsions,' which may take place weeks, or even months, after the patient has been hypnotized, in obedience to suggestions made during the trance; of which suggestions themselves nothing is remembered, the patient usually assigning for the act he finds himself irresistibly driven to perform, some pretext trumped up at the moment. It is obvious what power this gives to any unscrupulous operator who might wish to use his subjects as cat's-paws to crime. The remedy on the subject's part, if once he mistrusts the operator, would seem to be to get himself hypnotized by some other person, who, by suggesting that the former operator's proceedings should thenceforward be ineffectual, would in many cases actually render them so.

These inhibitions of certain processes by *negative suggestion* are among the greatest curiosities of hypnotism, and bid fair to put us on the track of important psychological secrets by isolating phenomena which usually are found combined. We may make a patient blind or deaf to special objects, and to nothing else, just as we may make him blind of one eye, deaf of one ear, or insensible to pain in one part of the body, — all by verbal suggestion that he shall become so. And the distinction that psychology makes between the mere *sensation* we receive from a thing, and the mental apperception or assimilation of the latter, so as to form a *percept*, is beautifully brought out in these experiments. For it seems that in them the blindness or other peculiarity is not the lack of sensation. A patient, for example, made to look at a red wafer on a sheet of paper, but told that there is nothing there, will not see the wafer — will say that the entire field of view is white. As soon, however, as the wafer is blown away, he will say he sees a green spot, its negative after-image. So a patient made blind to a particular by-stander cannot be made to see *him*. But how can the patient know *which one* to be blind to, without in some way discerning him? Some sort of a sensation of him must be there, or he would not be so singled out for invisibility.

The 'hemi-hypnotic' phenomena again afford a sort of moral vivisection of the patient into two halves. One side of the body may be cataleptic or lethargic, the other awake. One side of the face may be made to laugh, the other to weep. "If, in the hands of an open-eyed cataleptic subject, her knitting-work is placed, she takes it, and works away with remarkable skill. If the operator then close one of her eyes, the hand on the corresponding side falls inert, and the other hand continues all alone to perform the knitting movements, which, of course, then produce no effect." M. Richer describes a similar transformation of the act of washing the hands, into a unilateral operation. MM. Binet and Féré in some papers in the *Revue philosophique*, too late apparently to be noticed in Dr. Cullerre's book, have described most wonderful transferrences of the unilateral phenomena from one side to the other of the patient, whenever a magnet was brought near her, even without her knowledge. Many parts of their account are so startling that more verification is highly to be desired.

[1] *Magnétisme et hypnotisme.* Exposé des phenomènes observés pendant le sommeil nerveux provoqué. Par le Dr. A. CULLERRE. Paris, *Baillière*, 1886 [1885]. 16°.

Still more startling things are reported by MM. Bourreau and Burot of Rochefort, being nothing less than 'stigmatization' by suggestion, in a certain patient, i.e., the bleeding of spots of the skin at word of command. They have also seen, and convinced others, that this patient and one other, were influenced by medicines *in closed vials held near them*, salivated and sweated by Jaborandi, vomited by ipecac, purged by scammony, put to sleep by opium, etc. In these experiments the subjects were not hypnotized. They remind one of observations published long ago by Dr. J. R. Buchanan, and republished last year in his work, 'Psychometry.' Thus miracles expelled by 'scientific good sense' clamor again for admission. In particular the limits of suggestion have not to be re-tested. The new results seem to point towards some effects that may be direct and physical, and not due to suggestion or expectation. We are as yet but on the threshold of the subject.

If one wishes to see what hopes for success the method may inspire, one should read the brilliant article of Mr. F. W. H. Myers, entitled 'The human personality,' in the *Fortnightly review* for November. As Mr. Myers there says, we hold the wand of Hermes, which we have not learned to wield.

S. E.

THE UTILIZATION OF BY-PRODUCTS IN CHARCOAL-BURNING.

In many processes for the conversion of crude materials there is much waste, which is likely to be remedied only when such materials become scarcer, and hence more costly. In producing charcoal for use in the iron manufacture, the wood is commonly burned simply for the sake of the charcoal itself; and brick, dome-shaped ovens are used, from which the smoke and other products driven off by the process of slow combustion pass freely into the air. But in some cases such of the products as are commercially valuable are saved, with results that render it surprising that more care is not usually taken to retrieve what is so often lost. The success which has been met with at Elk Rapids, Michigan, in saving and profitably utilizing the by-products of charcoal-burning, is worthy of imitation.

At this place is a blast-furnace, turning out some seventy tons of charcoal-iron daily, and consuming the charcoal from one hundred and twenty-five cords of wood, previously carbonized in thirty-five kilns. The smoke and vapors given off in the latter process are drawn — by means of two exhaust-fans three feet in diameter, and making twelve hundred revolutions per minute — through the bottom of the kilns, and thence through a long wooden pipe forty-two inches in diameter, to the chemical works. Here the vapors are distributed to ten condensers, each containing seventy-five copper tubes two and a fourth inches in diameter, through which cold water is passed. So much of the vapor as is condensed is then drawn off into a large settling-tank: the uncondensed part is forced under the boilers by steam-injectors and burned, thus helping to furnish the motive power required at the works. In the tank the larger part of the tar settles to the bottom. This tar is now mixed with sawdust, and burned under the boilers; although formerly, when more in demand, it was drawn off and barrelled for market.

The remaining liquor is pumped to a second tank, and neutralized with lime. After the impurities have had time to settle, it is conveyed to a still, where the wood alcohol is distilled from the acetate of lime just produced. The liquor of acetate of lime is next evaporated by steam-heat nearly to the granulating point, then conveyed to grainers, and, by the further application of steam, it is obtained in the solid state. Finally it is shovelled out, drained, dried in pans, and put up in bags as the acetate of lime of commerce. The capacity of the works is 10,000 pounds of acetate of lime per day.

The alcohol, on issuing from the still, has a strength of eight per cent; but further distillation brings it to eighty-five per cent, when it is barrelled for shipment. It is, however, again refined by other parties to ninety-five per cent alcohol, and used for various mechanical purposes. The daily production can reach one hundred and seventy gallons.

An experiment has recently been tried at the London inventions exhibition aquarium, by Mr. W. August Carter, with a view to discovering how far fish are prone to sleep. After close examination, he found that among fresh-water fish the roach, dace, gudgeon, carp, tench, minnow, and catfish sleep periodically in common with terrestrial animals. The same instincts were found to actuate marine fish, of which the following were observed to be equally influenced by somnolence; viz., the wrasse, conger eel, dory, dogfish, wrasse bass, and all species of flat fish. Mr. Carter states, that, so far as he can discover, the goldfish, pike, and angler-fish never sleep, but rest periodically. Desire for sleep among fish varies according to meteorological conditions. Fish do not necessarily select night-time for repose.

SCIENCE.

FRIDAY, DECEMBER 11, 1885.

COMMENT AND CRITICISM.

THE STATEMENT that one of the chief applications of composite photography will be in the direction of producing more reliable portraits of representative men by combining the testimonials of individual artists, will probably be accepted by all who have followed the short but interesting career of this new invention. The suggestion that, by combining the individual conceptions of several artists, one would obtain a more reliable portrait than any of the components, was near at hand. The first such application was made by Mr. Galton himself. He made a composite of six medallion heads of Alexander the Great, and naturally claimed for the composite the combined authority of all the artists; for it is evident, that, while each artist will very likely express the general features of his subject, some peculiar idiosyncrasies of his own are apt to creep in. The composite sifts out all these common traits, and presents them strong and clear, while it reduces each artist's peculiarity to a scarcely perceptible shadow.

In this way we have recently come into possession of a new Shakspeare, for which we have to thank Mr. Walter Rogers Furness. In the case of Shakspeare the diversity amongst the several originals is strikingly evident, and thus a composite was needed to give a characteristic, individual, natural face. This suggested to Mr. W. C. Taylor the application of the same process to Washington's portraits. He has grouped the several portraits into three groups, owing to the differences of position of the portraits, and the accuracy of the work is well shown by the fact that the agreement amongst the resulting three composites is very close, while the originals show every shade of individual differences. These portraits were first published in the Journal of the Franklin institute, and are given on a new and enlarged plate in this number. The lower right-hand composite has seemed to many the happiest result, and seems likely to serve as the model for future portraits of Washington.

PRESIDENT CLEVELAND, in his annual message to congress, referred to several matters of interest to scientific men. Of the coast survey he says: "It was many years ago sanctioned, apparently for a purpose regarded as temporary, and related to a survey of our coast. Having gained a place in the appropriations made by congress, it has gradually taken to itself powers and objects not contemplated in its creation, and extended its operations until it sadly needs legislative attention. So far as a further survey of our coast is concerned, there seems to be a propriety in transferring that work to the navy department. The other duties now in charge of this establishment, if they cannot be profitably attached to some existing department or other bureau, should be prosecuted under a law exactly defining their scope and purpose, and with a careful discrimination between the scientific inquiries which may properly be assumed by the government and those which should be undertaken by state authority or by individual enterprise. It is hoped that the report of the congressional committee heretofore appointed to investigate this and other like matters will aid in the accomplishment of proper legislation on this subject." The recommendation to break up the present organization will certainly be received with regret by the well-wishers of the survey. For the signal service the president has suggestions which will be received by many of our readers with more favor. He says: "In view of the fact referred to by the secretary of war, that the work of this service ordinarily is of a scientific nature, and the further fact that it is assuming larger proportions constantly, and becoming more and more unsuited to the fixed rules which must govern the army, I am inclined to agree with him in the opinion that it should be separately established." Of this service, also, the president remarks that the scope of its operations should be definitely prescribed. He seems to fear that the scientific work carried on by the government may get beyond bounds, the nature of which, however, he does not define. At the close of the message the attention of congress is called once more to the need of providing quarters for the library of the capitol, the books of which are now kept in piles.

IT SEEMS PROBABLE that Pasteur will be able by means of observations on human beings to determine the practical value of his method of inoculation for the prevention of hydrophobia. On Dec. 4 six children in Newark were bitten by a dog which was probably rabid. It has been decided to send four of these children to Paris to be treated by Pasteur according to his method. Probably about sixteen or seventeen days will elapse between the reception of the bites and the beginning of the treatment. Regarded as an experiment, the value of the result of this treatment is increased by the fact that two of the children will remain at home, and will probably not be subjected to the treatment. Unfortunately the dog was killed, so that positive proof of its being rabid does not exist.

It is not difficult to find much to criticise in Pasteur's experiments on hydrophobia so far as they have been reported. It should, however, be remembered that these experiments have not yet been published in detail, and it is not probable that many points of criticism which readily suggest themselves have escaped so acute and accurate an observer as Pasteur. In fact, the main support of Pasteur's views lies in his established reputation as a cautious and far-seeing experimenter. As has been suggested in previous articles upon this subject in recent numbers of *Science*, it certainly seems a weak point that no micro-organism or characteristic lesion has been discovered by which it can be positively demonstrated that the disease which Pasteur produces in rabbits is hydrophobia. It has even been suggested that the disease of the rabbits is possibly only septicaemia. It will require a large number of observations on human beings before it can be proven that Pasteur's inoculations really prevent the development of hydrophobia. It is to be remembered that not a few of the dogs popularly supposed to be mad, and which are killed for this reason, are not affected with rabies. It is also abundantly established that a considerable proportion of those who are bitten by mad dogs never develop hydrophobia. Of those who are subjected to Pasteur's treatment, the wound has in most cases been already cauterized or excised, and this local treatment may account for the favorable result in some instances. But, notwithstanding all possible objections, there is still sufficient ground for confidence in Pasteur's conclusions to make it a matter of congratulation that the value of his treatment is to be so rapidly and so fully tested by its application to human beings. It has been recently announced that in one case, in which Pasteur began his treatment thirty-six days after the reception of the bites, the patient has died of hydrophobia. Pasteur attributes the unfavorable result to the long interval which had elapsed between the reception of the bites and the beginning of the treatment.

AT THE PRESENT TIME, when so much is said and written of 'mad dogs,' it may be well to recognize that, as the *Lancet* says, fear or nervous apprehension can induce a fatal disease having nearly, if not all, the characters of hydrophobia. It is not necessarily true that hydrophobia is always brought on by the mental anxiety that a dog-bite not infrequently occasions. Hydrophobia is a nervous disease, but it has probably a material cause, a poison, which is most likely a 'germ' or micro-organism. It is a curious fact that birds, even when inoculated with the poison of rabies, do not suffer from the disease; and some individuals appear to enjoy, with birds, the same kind of immunity. The *Lancet* further points out that whether it is those persons who are not given to fear or nervous apprehension who always escape hydrophobia, even though bitten by a rabid dog, we are not in a position to state. But nothing can be more detrimental to a bitten individual than to brood over his misfortune, or make himself miserable by learning all the symptoms of hydrophobia.

SINCE THE RESEARCHES of Pflüger have shown that the oxidation and reduction processes which are the basis of life take place, not in the blood, but in the tissues, attempts have been made to localize these processes. But up to the present very little progress has been made in this line of study. Prof. P. Ehrlich of Berlin has employed a novel method of studying this question, which consists in injecting colored substances which by reduction become colorless, and after death observing which tissues are colored, and which colorless, and, further, determining which of the colorless tissues become colored by oxidation outside of the body. Those tissues which after death are at first colorless, but which become colored by treatment with an oxidizing agent, were course, the seat of reduction within the The two colored substances used in n experiments were alizarin-blue

The latter is more easily reduced than the former, and when it was used a larger number of tissues were found colorless after death. Those tissues which were colorless when alizarin-blue was used were the seat of the most active reduction during life. The author does not profess to have done more than lay the groundwork for future investigation. The results thus far reached do not enable him to draw any very important conclusions, though his discussion is interesting and highly suggestive.

A NATIONAL UNIVERSITY.

SECRETARY LAMAR recommends in his annual report that a 'national university' be established in Washington. He says that "this national institution, which Washington, Adams, Jefferson, and Madison thought so necessary, has never been established; and in these later years the idea of a national university constitutes no part of the plans of statesmen, and seems to have been lost sight of by the people." This statement is not strictly correct, for it seems that in 1869 Dr. John W. Hoyt of Wisconsin brought before the National teachers' association, meeting that year at Trenton, N.J., a resolution, which was adopted, to the effect, that, in the opinion of that association, "a great American university is a leading want of American education;" and a committee was appointed to mature plans for such a university. This proposition was considered at the meetings of the association in 1870 and 1871, but there is no evidence that the committee ever did any active work.

Notwithstanding this inanition of the project, some action was taken by congress in the spring of 1872, looking to the establishment of such a university, when two bills were brought into the senate. One of these was drawn by Dr. Hoyt, who, although chairman of the committee of the national association, had never been able to get that committee together, and it was therefore essentially a bill presented by a private citizen. Neither bill was supported by anybody in any way; and the senators who introduced them did not imagine for a moment that any legislation would grow out of them.

Secretary Lamar calls attention to the scientific bureaus which "have grown up, one by one, under the government, with observatories, laboratories, museums, and libraries, until the whole range of physical science is represented by national institutions established by the government for the purpose of prosecuting researches, embracing astronomy, meteorology, geography of land and sea, geology, chemistry, statistics, mechanical inventions, etc.," and expresses an opinion, that, if these bureaus "could be combined as integral parts of one scientific institution, such an institution would be of greater proportions and more comprehensive than any other in the world;" and that, "should a university be erected thereon with a superstructure commensurate with the foundation, it would be without a rival in any country." This is a picture of a crowning unversity, richer, better, and more comprehensive than any existing institution, which may to some be fascinating.

By all these would-be benefactors of American education, many of the difficulties in the way of establishing a national university have been overlooked. In August, 1873, President Eliot of Harvard made a report to the National educational association on the then talked of national university. Although in his report we find little of "democracies having been the cradles of pure thought and art," or of a burning aspiration on the part of the American people for "a higher education, — higher than the common school or academy or college can furnish,"— we do find much of the cool common sense of that well-known leader of education.

We can hardly hope as yet that civil service reform is fully established in the United States. There is, therefore, a fatal defect in any congressional bill to establish a university, so long as the principles of appointment to United States offices, and the tenure of those offices, remain what they now are. A teacher should hold office through good behavior and competency, and it is only upon these conditions that competent professors can be secured for our colleges and universities. Permanence of tenure is necessary to make the position of a teacher one of dignity and independence; and young men of vigor will not enter a profession which offers no money prizes, unless they are induced by stability and peacefulness, and by the social consideration which attaches to it.

The government of a national university would necessarily be in the hands of some board of officers, and the constitution of such a board would lead to many difficulties. If the principle of local representation were to be applied, one would infer that the interests of Maine and Oregon, Minnesota and Florida, must necessarily be different, whereas philology, history, philosophy, science, and mathematics are the same in Massachusetts and Cali-

fornia. The professorships might as well be divided around among the states, as the places in the board of regents. The influence of sectional feeling could but be felt, and would certainly be injurious.

The demand by the American people for a higher education, referred to by Secretary Lamar, evidently means free education. The gift of such an education would rest in the hands of the members of congress, and would only place so much injurious patronage at their disposal. Our leading universities are already so well supplied with scholarships, and there are so many benevolent people standing ready to give assistance, that no deserving American boy need despair, from want of funds, of obtaining a liberal education.

Another point to be considered, before congress attempts to establish a university, is whether it would not be acting on un-American principles. During the war the country became accustomed to seeing the powers of the government exerted energetically for destructive purposes, and since the war there has been success in turning this power to the aid of the arts of peace, and markedly in the building of railroads. Had we not better leave the paternal government to Europe, and follow the example of our ancestors, who well understood, that, to make the people free and self-reliant, it is necessary to let them take care of themselves, even if they do not take quite as good care of themselves as some superior power might? We have already several good universities. Let us turn our energies to their development, and to the aid of those promised in the newer parts of the country.

THE DECAY OF THE OBELISK.

At the time the obelisk was placed in its present position in Central park, considerable discussion was aroused as to the ability of the stone to withstand the rigors of our climate. Upon examination the surface of the obelisk appeared so fresh, that authorities consulted at the time seemed to think that we need give ourselves no uneasiness as to the durability of the stone, and concluded that any action of climatic agencies would proceed with extreme slowness. Now, within less than five years, the commissioners of public parks in New York, acting under advice of Dr. Doremus, have found it necessary to cover the obelisk with a preparation of paraffine.

My attention during the past summer having been called to certain forms of weathering, due, as I supposed, to the expansion and contraction of the surface from excessive daily changes of temperature, I desired to examine the obelisk. Through the courtesy of the park commissioners, I was invited to inspect it at the time the scaffolding was first erected for the purpose of making a preliminary examination of the shaft from base to apex. While expecting to find some crumbling, I was quite unprepared for the rapid disintegration observed on all sides.

Comments upon the recent condition of the stone have led to some misconception as to the cause of the weathering. It has frequently been spoken of as the result of the action of the atmosphere, causing chemical decomposition of individual minerals in the rock. This is a mistake. The weathering, in my opinion, is almost wholly a process of disintegration, and not of decomposition.

At the time of the preliminary examination, the surface of the granite was found to be more or less in a state of disintegration; fragments being easily detached with any sharp-pointed instrument, while on the scaffolding pieces several inches in length were removed by means of the small blade of a penknife. One piece which I collected, taken from the west side of the obelisk, measured ten inches in length, and over one-half inch in thickness. A thin tabular specimen from the south face was four inches long by three wide. Since then, I understand, much larger pieces have been removed. An examination of both the firmer parts of the obelisk and the detached pieces present an equally unaltered condition of the constituent minerals. Indeed, the most marked feature of the rock is its fresh appearance.

A thin section of the rock, prepared for examination under the microscope, presents identical characters with those given by Dr. Stelzner of the Freiberg mining academy, who made a careful study of the mineral composition of the stone, to accompany the report of the late Lieutenant-Commander Gorringe. Little need be said here as to its composition. It is a hornblende mica granite, rich in felspar, with the relatively large crystals of hornblende greatly subordinate to the mica. The accessory minerals are magnetite, sphene, apatite, and zircon. It is in no respects an uncommon rock, and in America occurs in many localities in the far west. Even in minute details it bears the closest resemblance to the granite of the great Mormon temple in Salt Lake City. For building purposes the latter rock is probably the better, being more compact and finer-grained.

The microscopic section prepared for the purpose of observing what chemical decomposition, if any, had taken place, shows almost no alteration

product due to recent weathering. A slight decay of minute mica plates may be observed, but for practical purposes it amounts to nothing. The outer surfaces of the detached pieces are equally fresh with the inner surfaces. The felspar is scarcely more altered than when the rock was lying unquarried in the hills at Assuan. The decay is not due to chemical decomposition, but to mechanical disintegration.

In preparing the obelisk for its recent coating of paraffine, the workman carefully picked off with small iron tools all the loose scale and exfoliated material still adhering to the solid rock. My friend, Mr. Samuel Parsons, superintendent of parks, informs me that this refuse weighed 780 pounds, — a truly astonishing amount, when we consider that for 3,400 years the obelisk withstood the effects of time better in Egypt than during the last five years in Central park.

In my opinion, the process of disintegration has been an extremely slow one, caused by a constant expansion and contraction of the constituent minerals near the surface, due to diurnal variations in temperature. In a climate like that of New York, where these diurnal changes are frequently excessive at all times of the year, the tension between the minerals would naturally tend to a mechanical disintegration of the rock. Granite being a poor conductor of heat, the effect of these constant changes would be felt only at short distances below the surface, causing in time minute fractures and fissures along lines of weakness. Into these openings percolating waters, upon freezing, would rapidly complete the work of destruction. The result would be what we now find, — a scaling-off, or exfoliation, of the exposed surfaces. In structure the rock of the obelisk is coarse-grained ; and the minerals, being less firmly held together than in many more compact varieties, yield more readily to changes of temperature.

Observation showed that decay progressed somewhat more rapidly upon the south and west faces of the obelisk than upon the north and east. Upon the south and west the direct rays of the sun would act more intensely during the day, but the temperature by night would be nearly the same on all sides. Now, if the cause of the decay was due to expansion and contraction, disintegration would be greatest on the surfaces exposed to the severest strain (the south and west), notwithstanding that the opposite sides would be those most exposed to the driving cold storms.

It seems most probable that the obelisk, during its long exposure in Egypt, must have been slowly undergoing change, the minerals losing some of their cohesive power, and only required a lower temperature to hasten what had been in progress for ages.

Upon this subject the experiments of Professor Wigner, published in the *London analyst* of 1878, on rock from the twin obelisk now standing on the Thames embankment, are of considerable interest. Pieces of the twin obelisk were placed at Professor Wigner's disposal by Mr. W. Dixon, the English engineer, who had charge of the removal of the prostrate monolith from Egypt to London. They represented portions from the under surface, which had been buried in sands, and also from the upper exposed surface. Both pieces were found nearly free from chemical decomposition ; and analysis showed but slight oxidation of the iron in the surface rock. Experiments, however, upon the absorbent power of water of the two samples, gave widely different results. Professor Wigner estimated that the sound rock, which had been buried in sands, absorbed 7.8 grains of water per square foot of surface ; and the weathered or exposed rock, 46.1 grains per square foot of surface, or nearly six times as much as the fresher rock. He says, "The 46 grains from absorption per square foot gives us a comparatively fair estimate of the amount of water which can be retained in the weathered surface, and which is ready, by its expansion and freezing, to split or disintegrate that surface still further." According to Lieutenant-Commander Gorringe, a high authority, the London obelisk, which stood at Alexandria until the early part of the thirteenth century, was probably thrown down by the severe earthquake which visited northern Africa at that time. If we may assume, as is probable, that for the greater part of the 500 years the London obelisk was partially buried in sands, the difference in the absorbent power of water in the two specimens may be taken as measure of the effect of climatic agencies in Egypt during that period.

The New York obelisk, subjected to precisely similar agencies, would be in condition, after its transportation to America, to disintegrate rapidly when exposed to a lower temperature, and the consequent freezing and melting of the water absorbed through the interstices.

ARNOLD HAGUE.

Washington, Dec. 3.

THE MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

THE American public health association began its thirteenth annual meeting at Washington, Dec. 8.

After the opening ceremonies, a letter was read from the board of health of Montreal, stating that the epidemic of small-pox in that city was started by an imported case from Chicago, Feb. 28 of the

present year; that the spread of the disease was due to the obstinate opposition of the people to vaccination, but that it was now under control, and was fast abating, and the city would be free from the disease by Jan. 1.

The president, secretary, and other members of the Master plumbers' association of the United States, were elected members of the association, together with eighty-eight physicians, engineers, and others interested in sanitation, representing almost every state and territory.

The secretary reported the death of nine of the members, including Dr. Thomas of Savannah, Dr. Hatch of Sacramento, and Professor McSheny of Baltimore.

The treasurer reported that he had received during the year $3,338.13, had expended $2,233.10, and had on hand $1,105.03, with all debts paid.

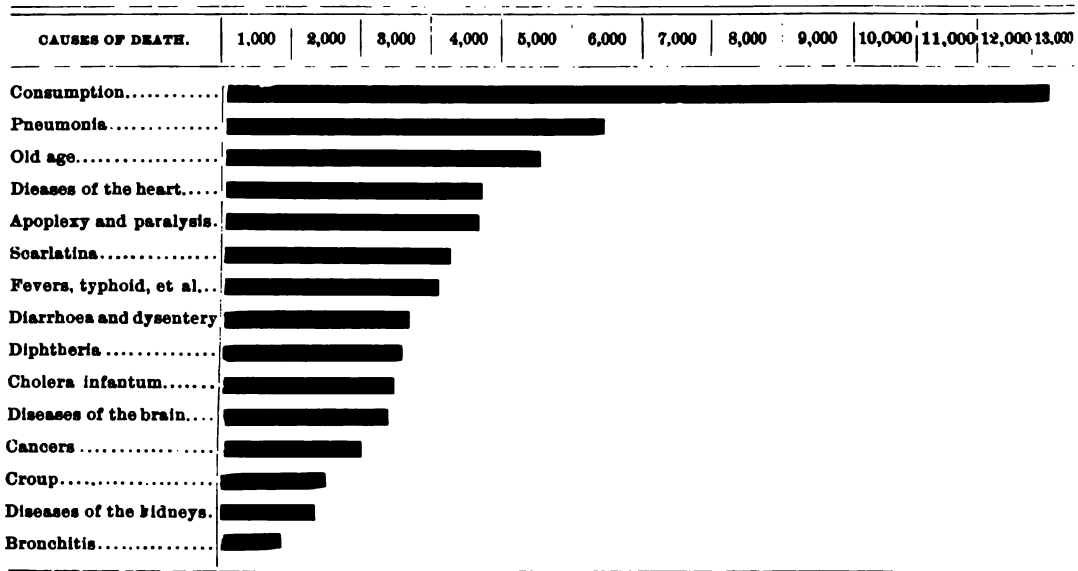
A committee appointed for that purpose in 1883 reported that they had incorporated the association for a period of 100 years.

The committee on disinfectants presented their report in printed form, — a volume of nearly 150 pages. The discussion of it was postponed to another day.

A paper was then presented by Charles H. Fisher, M.D., secr. state board of health, Providence, R.I., on 'Statistics of consumption in Rhode Island for a quarter of a century.' As this paper was simply a compilation of statistics, it was not read. It showed that during twenty-five years, 1860–84, there had been in the state 13,000 deaths from consumption, while during the same period there were only 6,500 deaths from pneumonia, 4,000 from scarlet fever, and 1,000 from bronchitis: that consumption was diminishing in the state, especially among the American born; and that in Newport county, not including the city, the deaths from this cause were less than in Washington county, on the other side of the bay. For this no cause had been recognized.

The next paper was on 'Sanitary and statistical nomenclature,' by E. M. Hunt, M.D., secr. state board of health, Trenton, N.J. The nomenclature of disease is very imperfect, and as a result there was a vast amount of discussion as to etiology, which would not be if all writers used the same terms with the same meaning. The word 'hygiology' was a far better term than 'sanitation,' or than 'sanitary science.' The word 'medicine' really meant knowledge by measurement, and as used in the expressions 'state' or 'sanitary medicine' was improper and unmeaning. 'State hygiene' would be much better. The terms 'contagion' and 'infection' were also referred to as being used in different senses by various writers, — some by contagions meaning those diseases which are communicated directly by contact; by infections,

DIAGRAM EXHIBITING THE COMPARATIVE MORTALITY BY ABSOLUTE NUMBER OF DECEDENTS FROM FIFTEEN MOST IMPORTANT CAUSES OF DEATH, IN RHODE ISLAND, DURING TWENTY-FIVE YEARS, FROM 1860 TO 1884 INCLUSIVE.



communicated indirectly through media. Webster and other lexicographers use the terms synonymously. Dr. Hunt thinks both terms should be discarded, and the word 'communicable' substituted. The term 'zymotic,' as applied by Tarr, received its impetus from Liebig's 'Chemistry of agriculture;' but there is now, with our present views, no use in retaining it. 'Epidemic,' as applied to those diseases which affect large bodies of the people, as nations; 'endemic,' those which affect localities; and 'sporadic,' which occur isolated, — are used with various meanings. The term 'sporadic' should be abandoned. In concluding, he thought the number of terms now used in the nomenclature of disease could with great advantage to science be reduced at least one-half.

FIG. 1.

TELPHERAGE.[1]

THE experimental telpherage train at Glynde, England, which was described in *Science* of Nov. 13, consists of an electric locomotive, seen in fig. 1 at about the middle of the train, and propelled by the electromotor *M* (fig. 4), and ten skeps, or buckets, which hang by their travelling-wheels from the steel line. Each skep weighs 101 lbs., and carries 250 to 300 lbs. of dry clay; and by distributing these evenly, and somewhat widely apart, the strain on the steel line is small, although the total weight of the train and clay is about two tons; also, as equal weights are simultaneously ascending and descending similar inclines on the several spans, the effect of the sag on the mechanical resistance of the train is neutralized, and little more resistance is experienced than in hauling a similar train along a rigid road.

The automatic governing of the speed of the train is effected in two ways, — first, there is a governor attached to each motor, which interrupts the electric circuit, and cuts off the power when the speed becomes too high; secondly, there is a brake which is brought into action should the speed attain a still higher value. To avoid the formation of a permanent electric arc when the circuit is broken, the governor (fig. 2) is so arranged that the diverging weights are in *unstable* equilibrium between two stops: they fly out at about 1,700 revolutions per minute of the motor, and fly back at about 1,600. When the circuit is closed, the current is conveyed across the metallic contact at *C*. When the weights *W W* fly out, this contact is first broken, but no spark occurs, because a connection of small resistance is continued at *B* between the piece of carbon and a piece of steel, which, being pressed out by a spring, follows the carbon for a short distance as the arm *A* begins to fly out. This contact is next broken, producing an electric arc; which, however, is instantly extinguished by the lever *A* flying out to the dotted position. The brake is shown on fig. 3, and consists simply of a pair of weights, *W W*, which, at a limiting speed greater than 1,700 revolutions per minute of the motor, press the brake-blocks *B B* against the rim *C C*, and introduce the necessary amount of retarding friction. In practice, however, with the gradients such as exist at Glynde, and which do not exceed 1 in 13, the

[1] Condensed from *Nature* of Nov. 5.

economic method of automatically cutting off the power with the governor is all that is necessary to control the speed of the train, the brake rarely coming into action. With steeper gradients, however, the brake would undoubtedly be very useful.

The way in which a single wheel-track is made to serve for one train, or rather two wheel-tracks

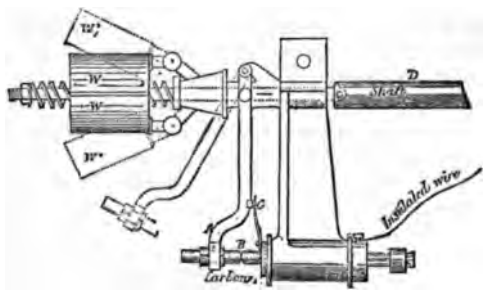


FIG. 2.

for two trains, instead of the necessity of having four wheel-tracks for two trains, as in the ordinary electric railways, is seen from fig. 4. [D is

It is found that for moderate inclines direct driving, with pitch chains, of two wheels with

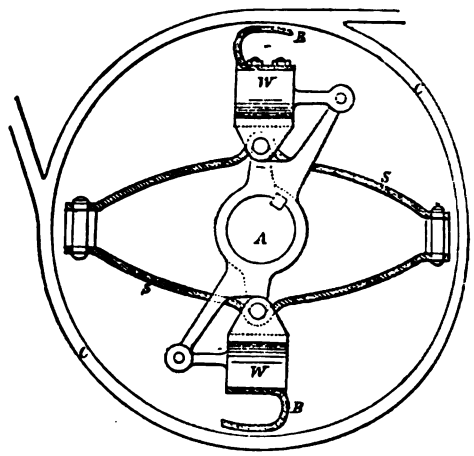


FIG. 3.

india-rubber treads, gives a gravitation grip sufficiently large for satisfactory haulage.

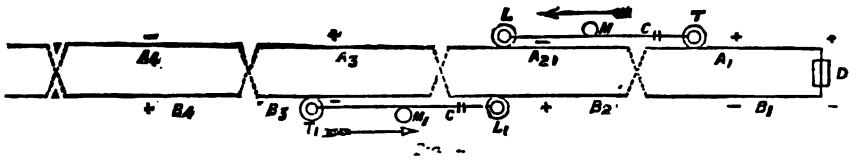


FIG. 4.

the dynamo maintaining two long conductors permanently at different potentials indicated by the signs + and — of each section. The wheels L and T of one train, and L_1 and T_1 of the other, are insulated from their trucks, and joined by a conductor attached respectively to the terminals of the motors M and M_1. A current, consequently, is always passing from a + section to a — section through each motor. Mechanically, then, each train is supported by what is practically one continuous steel rod; but in reality at the tops of the posts the rods are electrically subdivided into sections, and joined across by insulated wires, one of which may be seen at the top of the posts in fig. 1. The wires connecting the two skeps with the motor, shown in fig. 4, are not seen in fig. 1, as they were too thin to appear in the photograph from which this figure was taken. To prevent the metallic wheels of the skeps short-circuiting the two sections as they cross the tops of the posts, there are insulated gap-pieces, which may be seen in fig. 1, at the tops of the posts where the steel rod is electrically divided.

THE PRE-COLUMBIAN HISTORY OF GUATEMALA.

THE well-known historian of Spanish America, Antonio de Herrera, in describing the first conquest of Guatemala, states that the natives of the province of Utlatlan had 'painted records,' which carried their national chronicles back eight hundred years, that is, to about the year 700 A.D.

Utlatlan was the Mexican name of the region in western Guatemala inhabited by the tribe called Quiches, whose capital city, Gumarcaah, was destroyed by Alvarado in 1524. Its ruins are still plainly visible near the little village of Santa Cruz del Quiche. So complete was the havoc of the Spanish conquerors that not a single building was left standing; and, of those 'painted records' referred to by the historian, not a shred is in existence. Fortunately for the antiquary, intelligent members of the tribe learned to write their tongue in characters devised for it by the early Spanish missionaries, and took pains to apply this knowledge to the preservation of their tribal traditions. In some cases they had a practical incentive to this

to vindicate their claims to hereditary Hence several of these documents are itulos,' or family titles.

of these native writings were lost; so that, all, only four are certainly known to be nce. They are named in the note,[1] and it een, that, while they are now all accessible two have appeared only within a year, are merely Spanish translations without inal text. The 'Popol vuh,' or 'national f the Quiches, is already well known to About one-half of it is concerned with ious myths of the Quiches, the remainder ir historic traditions. The precise date of position is uncertain, but it may be as- o the last half of the sixteenth century. tulo de Totonicapan' is officially dated in e title of the Princess Nehaib is somewhat d refers to lands south-west of the Quiche , in the province of Soconusco; while the of the Cakchiquels' were written by a ho was already a married man when the troops first entered his country. The uels, it may be observed, were of the same and language as the Quiches, and adjoined the east.

four publications, therefore, offer to stu- ho would investigate the pre-Columbian of Central America a large amount of ic aboriginal material. We may say that ver yet been utilized; for the Abbé Bras- his 'Histoire du Mexique,' was utterly un- and spun a romance from these writings, hich he had consulted; while Mr. H. H. had never seen three out of the four prepared his 'Native tribes of the Pacific nd his 'History of Central America.' A son shows that all the native writers drew ne common stock of national legend; all at the regions they occupied were their homes; all refer to some distant land in or north-west, beyond the sea, as the resi- their ancestors. An echo of ancient tradition floats through these earliest ences. We hear of the wondrous city of e mysterious land of Zuiva, and of bat- the Nonoalcos. But the many problems d by these writings cannot even be men- tioned here. As a whole, they offer the most complete body of American mythology and legend extant.

[1] *vuh; le livre sacré des Quichés.* The original a French translation by the Abbé Brasseur de . (Paris, 1861.)
de la casa de Ixcuin-Nehaib. Edited by Don rrete. (Guatemala, 1873.)
le los Señores de Totonicapan. The Spanish text, rench translation by M. le Comte de Charencey. 1885.)
nals of the Cakchiquels. The original text, with an anslation by Dr. D. G. Brinton. (Philadelphia,

GEOGRAPHICAL NOTES.

Heights of mountains in Lapland. — Recent explorations of Swedish Lapland by Bucht Svenonius and Rabot have revealed the existence in the department of Norrbotten of a mass of mountains, of which several summits rise considerably over 6,000 feet. Their ravines enclose numerous glaciers. The highest is called by the Lapps Kebnakaisa, is situated in latitude 68°, a degree and a half eastward from the meridian of Stockholm, and between the Luleo and Torneo lakes, and by trigonometrical measurement appears to be 6,940 feet in height. The two next highest are Kaskasatjokko, 6,800 feet, and Sarjetkt-jokko, 6,760 feet, approximately.

Northern Norway and Finland. — The observations of Charles Rabot in the mountainous area of Store Baergefjeld, in Nordland, arctic Norway, represented on the best charts as occupied by an immense continuous glacier field, show that it has been wholly misunderstood. There is no primary glacier, but merely seven secondary glaciers, isolated in ravines, and hardly passing beyond the stage of *névé*. Their total area does not exceed six square kilometres, about one-fiftieth of the area formerly supposed to be ice-covered. The field is not a plateau, but to the north a mountain mass, whose culminating points reach nearly 6,000 feet, and which averages 3,600 feet; and to the south a densely wooded tableland, cut with myriads of deep and regular cañon-like valleys. Fir-trees three feet in diameter a yard above the ground were not rare. After completing his work on the field, Rabot made explorations in the Kola peninsula of Russian Finland, determining the existence of three distinct chains of mountains between the Polar and White seas, which reach a height of more than 3,000 feet. The country has hitherto been charted as a sort of plain, broken merely by lakes and low hills. The area between the ranges is level, and trees of good size and form reach latitude 68° 50′; beyond they extend some distance, but do not exceed twelve or fifteen feet in height. Collections were made of geology, terrestrial and fluviatile mollusks and fishes.

Connecting the Volga and the Don. — The project of connecting the Volga and the Don dates back to 1568, when Selim, the son of Solyman the Magnificent, besieging Astrakhan, attempted to join the two rivers in order to transport material of war. His work was brought to an end by the power of Ivan the Terrible, czar of Moscow. In 1700, aided by John Perry, an English engineer,

the work was attempted by Peter the Great, but at the end of a year, after his defeat at Narva, Peter abandoned the project, which has since that time been periodically discussed. In October last M. Léon Dru, a French engineer, having surveyed a line, was convinced that the project was practicable, and experimental borings have already commenced.

A ruined city found in Asia Minor. — In the province of Adana, Asia Minor, not far from Tarsus, at a few hours' travel from the sea, among the mountains, has recently been discovered a ruined town hitherto entirely unknown. The ruins lie near the route from Sélef-Ké to Karaman by Mohara. Sarcophagi almost intact, and resembling those of Lycia, exist there, and would seem worthy of study.

Monuments of Babylonian times. — It is stated that an archeological expedition, under Professor Niemann of the Academy of fine arts, is fitting out in Vienna for the exploration of those parts of Taurus and Anti-Taurus where last year were found remains of monuments dating from Babylonian times.

Siberian interest in geographical exploration. —An exploration, to cover a period of five years, is being organized by Yadrinteeff, under the auspices of the Russian geographical society. Its purpose is the investigation of the ethnology and social economy of Siberia. The party will consist of young men, who will be distributed over different parts of that immense region for purposes of study. Residents of Siberia have already manifested a laudable interest in such investigations; and beside museums at Irkutsk, Omsk, Yeniseisk, and Tomsk, M. Martianoff, at Menusinsk, in the Yenisei government, has already gathered a collection of more than six thousand archeological and ethnological specimens.

The trans-Siberian railway. — The trans-Siberian railway has already finished its first section of 135 kilometres between Ekaterinburg and Kamishoff, and its early completion to Tiumen is confidently expected. The canal between the Obi and the Yenisei is already so advanced that navigation will probably be inaugurated on it by the spring of 1887, if not even earlier. Sibiriakoff has established a line of steamers on the Angara, which unites Lake Baikal to the Yenisei, and which has been thought too turbulent for navigation.

The old bed of the Oxus. — Daniloff, in examining the Oxus, has found what he reports to be the point of its ancient bifurcation into the Amu Daria and the Uzboi. In opposition to the opinion of M. Lessar, chronicled in these pages, but confirming that of Kalitine, Daniloff believes that the latter is right in his mapping of an ancient bed in the desert, called the Uzboi or Uz This will soon be levelled throughout its e and the conflict of opinion be settled b more exact methods of a careful survey.

ASTRONOMICAL NOTES.

Equatorial currents in solar and planetary mospheres — Of the bodies of the solar syste sun, Jupiter, and the earth are the only one have thus far distinctly shown any decided ence of rotation-period, either for different of their visible cloud-surfaces, or for a gaseo mosphere and the solid or cloud-surface which it sweeps. Of these, Jupiter offers the greatest variety of detail, but it has neve adequately observed until the sudden appea of the 'great red spot' in 1878 attracted versal attention to the planet. The resul been, that not only has this red spot, which visible, been shown to have a definite and constant rotation-period, not varying many onds from $9^h\ 55^m\ 37^s$, but certain white spots equatorial belts are found to be permanen tures for several years in succession, and to h rotation-period (about $9^h\ 50^m\ 10^s$) decidedly sl than that of the red spot, but equally consta that their conjunction-times, as they swe each other, can be predicted pretty accurately tailed micrometric work upon these spots and like that described in Professor Hough's a reports, is especially valuable, and there is of work still to be done upon the other deta the planet's cloud-surface. As to the sun, it i known that the spots give a rotation-peri about 25 days for the solar equator, slowing about 27.5 days at latitudes of 45°, beyond there are not sufficient data for fixing any p But we think hardly sufficient attention has paid to the fact that Professor Young's ob tions (*Amer. journ. sc.*, 3d ser., xii. 321) upo displacement of lines in the spectra from th and west limbs of the sun gave for the equa velocity of the chromosphere $1.42 \pm .035$ mil second, while the equatorial sunspot-period only 1.25 miles for the photosphere. It is a strong indication that the solar atmosphere s forward over the photosphere; and its bearing the probable behavior of the corona and me matter falling into the sun would seem to ca a redetermination of this line-displacement the more powerful dispersion now availa Rowland's gratings. As to the earth, we that the general drift of the lower atmos currents is eastward, rotating faster than the itself; but of the circulation high up abo clouds we knew absolutely nothing until th

sunsets following the Krakatoa outburst (whose explosion of 1883, Aug. 27, drove whole cubic miles of dust and steam, if not clear through our atmosphere, at least many times higher than the clouds ever float) indicated by their successive appearances at different places a probable upper equatorial current moving rapidly westward, i.e., rotating slower than the earth. We do not think the discussion of these red sunsets is, from this stand-point, by any means exhausted, and hope that Professor Kiessling of Hamburg, who has so well explained the physical causes of the phenomena, will publish the thousand or more records he has of the first appearances of the red sunsets all over the world. The only other occasions when these upper currents can be observed are the rare chances when the drift of a long-continuing meteor-streak might be determined from two or more observatories. If workers with equatorials would endeavor, on those rare occasions when a meteor-train remains visible, quickly to begin a series of pointings (using the lowest power) alternately upon the two ends of the streak, noting the times and reading the hour and declination-circles as rapidly as possible, we might in time accumulate some valuable data about the upper currents in our latitudes; but observatories near the equator are scarce. However, the knowledge thus gained of the heights at which meteors appear would be much more accurate than from the ordinary alignement among the stars, and these observations ought to be made on every possible occasion by astronomers.

Two new comets. — Two new comets have already been discovered during the present month. The first was found on Dec. 1, at Paris, the name of the discoverer not being given in the telegram. The comet was readily picked up by Professor Frisby of the Naval observatory with a 2¼-inch finder, and the following observations were obtained with a 9.6-inch equatorial: —

Date.	Wash.M.T	α	log $p.\ \Delta$	δ	log $p.\ \Delta$
1885.					
Dec. 2	9h 20m 2s	0h 36m 11s.11	9.285	+21° 0′ 20″.2	0.460
" 3	8 10 56	33 53 .93	8.795	20 58 46 .7	0.433
" 6	6 27 6	27 7 .81	9.079 n	20 54 3 .5	0.443
" 7	6 58 54	24 50 .81	8.593 n	20 52 35 .7	0.434

It has been described as ill-defined, and slightly condensed towards the centre, — without a tail. The second comet is announced in a telegram from Prof. Lewis Swift, who states that the comet was discovered by Mr. E. E. Barnard of Nashville, Tenn., on Dec. 3, its position being at $9^h\ 37^m$ (probably Washington mean time) R.A., $4^h\ 21^m\ 57^s$; Dec., + 4° 45′. The motion is given as 35 minutes, but the direction of the motion is made unintelligible by the ambiguous term 'north west.' In the position just given, the comet would pass the meridian a few minutes before the bright star Aldebaran, but nearly twelve degrees farther south.

NOTES AND NEWS.

THE work of the Henry Shaw school of botany, St. Louis, outside of the university classes, will begin with the formation of a class for the study of grasses. For the accommodation of teachers in the schools of the city, this class will meet from 9 to 1, on Saturday mornings. A class in analytical botany will take up the study of spring flowers on Tuesday and Thursday afternoons, and Saturday mornings, from April 6 till June 12, 1886.

— Those interested in composite photographs will find a plate of four of members of the National academy, in *Science* of May 8, 1885; another, from a composite photograph of several skulls, in the number for June 19; a third, of the officers of the American association at the Philadelphia meeting, in the issue of Aug. 28; and a fourth, showing the racial characteristics of Jews, in *Science* of Oct. 9.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writers' name is in all cases required as proof of good faith.*

Newcomb's 'Political economy.'

PROFESSOR NEWCOMB objects, in the last number of *Science*, to certain things in my recent notice of his work on political economy, charging me with 'atrocious misrepresentation' of his views. The quotation-marks enclosing two sentences in the first paragraph of my review should not have been there, and, so far as they led my readers to think that they indicated Professor Newcomb's own words, they were misleading; and an apology is due Professor Newcomb from me, which is hereby tendered. I may simply say, by way of explanation, that the proof of my article was not submitted to me in time to receive any corrections at my hands before it was printed, or the offending marks, as well as the word *always*, to which the author objects later in his letter, would certainly have been expunged.

As to the chief point at issue, however, viz., whether my article presented a correct view of Professor Newcomb's theories, I have nothing to take back or change. I have again examined Professor Newcomb's book, in connection with his strictures on my review, and do not see wherein I have misrepresented him. The point in dispute, of course, is not what Professor Newcomb desired or tried to do, nor even what he claims to have done, but simply what he actually did do in the work reviewed. It is true that he expressly disclaims any intention of doing what I maintain he has done; but this is no evidence, of course, that my view of his actual work is erroneous. The notice contained my opinion of the real work, and not of the author's

intentions. The proof of the correctness of my opinion cannot be given within the space which you can allot to the discussion, since it involves a careful comparison of Professor Newcomb's premises and conclusions, of his declared intentions and his actual success. The following sentences, taken somewhat at random from the book, seem to me to prove the general justness of my view. The italics are mine. Page 543 (Summary of principles): "The motives which animate men in the pursuit of wealth are in the highest degree beneficent, and have led to a *system which insures to every man fit to live the maximum of enjoyment from his labor*, if he will only adapt himself to the system." Page 518: "It is also to be remembered that the *existing system insures the employment of every man in the way best suited to his talents* better than any other system *possibly* can. *This fact follows from almost the whole system of political economy, so that it need not be further dwelt upon*" Pages 517 and 518: "Thus, from an *idealistic* point of view, nothing can be said against the general equity of the *existing system of free competition*." Page 516: "It is a great mistake to suppose that the enormous inequalities which we see in wealth imply any thing wrong in the system which permits them." Page 370: "We have already shown that in the state of things which now exists in this country it is *scarcely possible for any industrious man* to suffer for the necessaries of life."

These quotations, it seems to me, present a fair view of what should be regarded as the logical outcome of the methods and principles of the book. The author is not consistent in his reasoning, and this leaves him abundant opportunity to quote passages which are at entire variance with what I represented as the result of his effort. It should also be said that they are at entire variance with the conclusions above quoted, which latter are, in my opinion, more in harmony with the general drift of the book than the former. As one interested in the progress of the science, I am glad to know that Professor Newcomb recoils with such vigor from the logical consequences of his theory, as we may hope that his influence will at last be thrown in the direction of sounder methods than those which he so vigorously repudiates and so closely follows.

In conclusion I should like to say that my objections are nearly all to the general methods and tendencies of the book. I think, as I said in essence in my review, that many of the minor discussions are admirable and suggestive. E. J. JAMES.

Professor Newcomb may well repeat the answer [illegible] to be delivered from his friends if Mr. Franklin's letter fairly represents their best efforts. With the single exception of what has been already answered, the letter is extraordinarily vaguely in its statements.

To begin with its last point, he remarks that the [illegible] sentence of my review was "timely and [illegible] criticisms as Professor Newcomb was [illegible] of what governments do when they establish an [illegible] monometallic system." Professor Newcomb's [illegible] sentence might possibly have been expressed in the [illegible] of carelessness of statement, but it [illegible] agree with Mr. Franklin, and still desire to stand [illegible] it is its accurate [illegible] it would simply be another instance of one of my chief objections to Professor Newcomb's general methods, viz., that he is dealing all the while with imaginary quantities. It is safe to say that neither Professor Newcomb nor Mr. Franklin can adduce a single historical example where "governments, in establishing a bimetallic system, assumed that the values of equal weights of the two metals have a certain fixed ratio to each other." They have sometimes assumed that *by establishing* such a system they can do much toward creating such a fixed ratio, which is an entirely different thing. The statement of Professor Newcomb is doubly objectionable, — in the first place, because it is not true; and, in the second place, because it is the form usually adopted by one-sided monometallists in describing the position of bimetallists, so that they may forestall discussion by ascribing to their opponents such an absurd theory as to make them appear a pack of drivelling idiots. I prefer to think that Professor Newcomb does not desire to bolster up his position by any such questionable devices.

Mr. Franklin asks how much of the influence of recent German writers on economic science is traceable in Professor Sidgwick's book. The mere question proves one or both of two things: 1°, that Mr. Franklin is only superficially acquainted with Professor Sidgwick's work; or, 2°, that he knows nothing of recent German writers on political economy; or, 3°, both. The influence of German thought is evident on nearly every page — certainly in every chapter — of Professor Sidgwick's book. Some of the chapters, indeed, — notably the one on public finance and that on distributive justice, — might almost be called abstracts of Wagner. I did not say that Professor Newcomb knows nothing of recent political economy, but simply that his treatment of the subject shows no traces of such knowledge. To give evidence of such knowledge, it is not necessary, of course, to quote from recent works. One might reveal the fact in one's methods and conclusions that the gigantic movements of the last generation had not swept by without in some degree affecting the views of the writer. A man who writes a work on physics need not stop to trace out the authority for each statement he makes in order to show that he is abreast of the time. To do that would be as absurd in form as it would be in reality, if he attempted to write such a book without taking any notice of the work done in that department within the last generation.

Whether it be evidence of ignorance and incompetence in any one to adhere to the system of a past generation when another system, whatever may be its merits or defects, has certainly displaced the old one, may fairly enough be left to the sober sense of men of science and to the practical answer of a moving world. It seems pretty clear that Mr. Mill, to whose methods and system Mr. Franklin implies that Professor Newcomb adheres, would indignantly repudiate any such views as those above quoted from Professor Newcomb's book, since he regarded them as already obsolete at the time when he wrote.

I did not say nor did I mean to imply, that Professor Newcomb had not the right to make excursions into the economic field, but that these excursions had always been of a hasty and desultory character, since the better part of his life and effort had been devoted to something else, and further that the whole result of his investigation was that we should now see an example of the true scientific method, the failure to apply which, so far was the real secret of the failure of political economy. E. J. J.

The Biela comet meteor-stream.

The showers of meteors from this stream (see *Science*, vi. 489 and 496) were observed not only very extensively on the night of Nov. 27, but also at some places on nights preceding and following this; and a complete collection of all the observations should be made in order to study the distribution of matter in the stream. We should be glad to receive from everywhere reports of observations of these showers; and they should give, as fully as may be, the following data: 1°. The time the observations commenced, whether in twilight or darkness, and whether the shower seemed to be beginning or already in full operation. 2°. The clearness of the sky, and freedom from interference of trees, street-lamps, etc. 3°. If a continuous count was kept, the rate at which it proceeded (as illustrated on p. 490 of last week's *Science*), the number of observers, and how stationed. 4°. If no count was kept, then the time of any marked variations in the density of the shower. 5°. The time the observations ended, and whether the shower appeared to be over; and, if so, whether any further watch was kept for a renewal of it, and how long. 6°. The appearance of the meteors, especially the color of the brighter ones and of their trains, if any; also if any appeared to describe *curved* paths. 7°. If the observer was reclining so as to watch all round the radiant equally well, or, if there was an observer for each quadrant, then some approximate indication, if possible, of the relative density in each quadrant; and, if this varied decidedly, then the times of the variation.

Probably few can give much information on the last point, but it would be valuable in discussion of local differences in the showers. There are some indications of this at stations not many hundred miles apart, which, if they are real, indicate a considerable *bunchiness* in the meteor-stream within very moderate distances. These will always be interesting showers to observe, not only for their connection with the lost comet, but also because they come into our atmosphere with low velocities, nearly on the *following* side of the earth, and hence are conveniently observed in the evening and with the radiant near the zenith, — very rare characteristics of well-marked showers.

Some features of the meteor-orbit may be of interest. Assuming the elements which Santini computed (*Astr. nachr.*, L. 124) for the unobserved return of the comet in 1859 as the latest computation of its probable motion, they show that the orbit is an elongated ellipse inclined about 12° to the earth's orbit, with a perihelion distance of .87 (the earth's mean distance being unity) and an aphelion distance of 6.21 (Jupiter's mean distance is 5.20), and that the aphelion is only .92 from the plane of the ecliptic; thus making it highly probable that Jupiter pulled the comet into the solar system originally, and showing that it can still perturb its motion considerably. The most interesting feature (the one which makes the meteor-showers possible) is that, according to Santini's elements for 1859, the radius-vector of the comet at its descending node equals .992, while that of the earth at this point is .986, — an approach within .006, or about 550,000 miles. This small distance, however, is liable to have been changed by several times its whole amount by perturbations since then.

At this node the velocity in the comet-orbit is 24.3 miles per second, while the earth's is 18.7; and as the motion of the comet is direct, the inclination only 12°, and the angle between the radius-vector and the normal of the comet-orbit only 18°, the meteors enter the earth's atmosphere from the apparent direction of the radiant in Andromeda, with a velocity of only 9.8 miles per second, thus causing their sluggish motion, which perhaps would be even more marked were it not likely, that, on account of their slow speed, they are consumed at a somewhat lower level than the swift showers, and hence appear relatively too fast from greater proximity.

Of course, there can be no shower unless there are meteorites scattered along that part of the orbit where the earth reaches the node about Nov. 27. Santini's elements make the passage through the node about thirty days before that through perihelion, and give the following series of times for the successive crossings of the node, the period being 6.67 years. The next column gives the elapsed intervals from these times till the nearest earth-crossing about Nov. 27.

Date of comet's node-passage.	Distance of comet beyond node Nov. 27.
1839.31 (April 23)	−5 months.
1865.98 (Dec. 24)	−1 "
1872.65 (Aug. 25)	+3 "
1879.32 (April 27)	−5 "
1885.99 (Dec. 27)	−1 "
1892.66 (Aug. 29)	+3 "
1899.33 (May 1)	−5 "

The only recently observed showers certainly attached to this stream, so far as known to the writer, are those of 1872, when the comet was already three months past the crossing, and the one just happened, when, according to the same elements, the comet should not have crossed till a month afterwards. There appears to have been no well-marked shower observed in 1865, when, with imperturbed elements, the circumstances should have been almost the same as this year; and the difference is, no doubt, due to the increased diffusion of the stream and the perturbations since 1859. The phenomena of 1892, as compared with those of 1872, will furnish some evidence on this point; but, as the perturbations of this stream are pretty large, the above times may very likely be wrong by some months at the end of the century.

This is by far the most interesting meteor-stream we have to deal with as yet, and the study of its special perturbations would seem to be well worth making. After the passage of the double comet in 1852, the *Academie des sciences de St. Petersbourg* offered a prize (*Astr. nachr.*, XXXVIII. 95) for a full discussion of the whole theory of the comet from its discovery in 1826 to its expected re-appearance in 1859; but no one seems to have undertaken the work at that time. Perhaps its discussion at this day, extended to its perturbations as a diffusing meteor-stream, would be worthy of a prize.

H. M. PAUL.

Washington, Dec. 5.

The Biela meteors.

On the evening of Friday, Nov. 27, at 6.15, I observed a meteoric shower of considerable proportion. In taking a casual glance at the heavens after tea, my attention was at once attracted by several meteors, which followed in such rapid succession that I was able to count twenty in less than five minutes. They appeared all over the heavens, and, among the great number observed during less than half an hour, the radiant point of but one was other than in the con-

stellation Perseus. My observations were unavoidably interrupted. At 10 o'clock I again scanned the heavens, but the shower had then subsided.

ROBERT D. SCHIMPFF.

Scranton, Penn., Nov. 28.

Natural gas in Illinois.

In an editorial note in *Science* for Nov. 20, there is a reference to the failure of the natural gas-wells in Champaign county, Ill. In all, there are only about a dozen gas-wells in this county. In two, which are near together, the pressure is about twenty-five pounds per square inch: in the others it is only a few pounds. After personally investigating a number of wells, the writer concludes that there has been no marked decrease in the supply, the failure of any particular well being due to an accumulation of mud and water rather than to an exhaustion of the supply. With one exception, all the wells require pumping out every two or three months. The gas is nearly pure marsh-gas, and is found at a depth of 70 to 90 feet, in a layer of loam from 3 to 12 feet thick. Inferences drawn from the Champaign county wells are inapplicable to the Pittsburg wells.

Near Litchfield, this state, natural gas has been found which in quantity, quality, and source, is similar to that of Pittsburg. I. O. BAKER.

University of Illinois.

International geological congress at Berlin.

I have just read in *Science* for Oct. 30 your interesting article on the international geological congress at Berlin. Will you permit me to point out one error which has escaped your attention? It is in regard to the bracketed clause which comes at the end of the first column on p. 378: 'the lower . . . beds.' This phrase is inaccurate. Professor Geikie asked for the suppression of the words 'lower carboniferous' and 'calciferous sandstone.' I accepted this without opposition because it was expressly understood that the typical localities referred to in my report (Kilborkan, Marwood, Pilton, Dura Den) ought to be included in the upper Devonian, as the report of the commission defines it.

As to the following sentence, 'The whole paragraph (c) was afterward suppressed,' I do not know upon what it could have been founded. I have not the least recollection that there was any suggestion of the suppression of that paragraph, and you can be sure that such a proposition would have given rise to an animated discussion. G. DEWALQUE.

Liége, Nov. 13.

The English sparrow.

The American ornithologists' union has collected evidence from all parts of the country where the English sparrow occurs, and has published a report based upon their investigations. As I stated in *Science* (No. 144), they have urged that laws be passed against it, looking to its entire extermination. Acting upon this advice and upon experience with the pest, several states have repealed their protective laws, and the bird is now under the ban. Every one who has seen the bird in the east knows that it drives away native birds, destroys fruit, and is disagreeable in every way.

In regard to a means of destruction, let every state offer a small bounty for birds and eggs, small boys will do the work. A bird is not at parable with locusts or mosquitoes. Intelli instinct as we may call it, makes the vast dif We might persecute insects till the end of ti they would still come upon us each year; b are very quick at seeing whether or not t wanted. If they are persecuted, they insti draw away from man, as in the case of th We may not be able to entirely rid ourselve pest, but we can at least succeed in drivin away from the cities; and once get them i country, where they can be taught to fear t gun, and we shall have them at least un control. They can be driven away from th if their nests are demolished as soon as made all the bird-houses are removed. A careful poison might also work with advantage, an large parks the shotgun in the hands of co men could be brought into use.

I will add that if any of the readers of are troubled with the sparrow in ivy or othe by sprinkling red pepper among the leaves t soon be rid of the pests. This has been tri success. RALPH S. T

Washington, D.C., Dec. 4.

The results of shad propagation on the A coast.

In your issue of Nov. 13, p. 434, I see it st Colonel McDonald that the rivers draining i Atlantic, from Cape Cod to the capes of the peake, together with the submerged cont border lying between the coast-line and th Stream, constitute an area "within the lin which the migrations of the shad are confined.

Is this true? It certainly was not true years ago; for at that time, I am quite sur were abundant in all the southern rivers. I w member that they were especially abundant a in the Ogeechee, ten miles south of Savann have not been in the southern states in shad since 1869, and therefore cannot speak from pe observation since that time, but I have no doub the same is still true. JOSEPH LECO

Berkeley, Cal., Nov. 21.

Crystals in maple sirup.

I send you a photograph, kindly furnished be Arthur W. West, of some large crystals which f on the inside of a glass jar of maple sirup. sirup was made from the rock maple, Acer sac num, during March, 1885, by Elias Fogg, Es Maple Ridge, Sandwich, N.H. As this is the time that crystals have been noticed to form i sirup by Mr. Fogg, or any one in Sandwich, I th it worthy of notice. I would suggest as a theo account for this crystallization that for the past or three seasons there has been a considerable dr in that part of New England, and the maple have therefore been less gorged with water formerly, so that the sap is composed of a larger portion of sugar as it comes direct from the t Mr. Fogg says that there has been no differen the process of making the sirup, but that it k better, and is less liable to mould. J. H. SEA

Salem, Mass.

THREE NEW PORTRAITS OF WASHINGTON.

SCIENCE, *December* 11, 1885.

SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 11, 1885.

PHYSIOLOGY OF THE BRAIN.

THE recently published memoir of Dr. J. Steiner[1] is an especially important contribution to this very difficult field of research, and one which is likely to have influence not only from its intrinsic merit as an investigation, but also from the unusual literary excellence characterizing the author's presentation of his subject. The frog was chosen for the experiments on account of the comparative simplicity of its brain. The experiments consisted in a series of systematic removals of portions of the brain; and to the thoroughness and patience with which this system of study was executed the success must be attributed. Steiner removed first the hemispheres, and records in his memoir the observed results; next both the hemispheres and optic thalami; then the mid-brain; then the cerebellum; finally the upper part of the medulla. Then follow experiments with asymmetrical removals. Together with the description of each operation is given the account of the physiological phenomena which ensue from it. The discussion of the interpretation of the observations is kept separate, — an essential advantage to the reader.

The most important conclusion reached is, that in the anterior portion of the medulla oblongata there is a common centre for the co-ordinated movements of the head, rump, and limbs; or, in other words, that we cannot separate the three centres topographically, and can establish the fact of their organic connection. This central office Steiner names the brain-centre (*hirncentrum*). By ingenious experiments and reasoning he renders it probable that the upper parts of the brain (*bigemnia*, etc.) contain no general co-ordinating motor-centres, but only sensory centres and pathways; that is to say, they act to the brain-centre the *rôle* of centrifugal nerves, and the brain-centre is the only locomotion centre of the body.

The relation of the brain-centre to the reflex centres of the spinal cord is very remarkable, and is demonstrated by the reactions of a frog deprived of its hemispheres to irritations produced by varying strengths of sulphuric acid placed on the skin. The strength is gradually increased until a reaction occurs. The first reaction is a locomotion; a little stronger, and there is first a locomotion, and then the well-known reflex wiping motion to remove the irritant; the wiping motion causes the stoppage of the locomotion — the interpretation of this fact is that the brain (locomotion) centre is more readily excited than the reflex centre in the cord, and that the reflex centre inhibits the action of the brain-centre. This is another of the increasing number of instances of the reaction consequent upon stimulation of a given part varying with the strength of the stimulus. This discovery already appears to us of very far-reaching significance for the future of nervous physiology.

In a second chapter the author establishes asymmetrical injury of the brain as the cause of compulsory curvilinear motions (*mouvements de manège, rollbewegungen*, clock finger movements, etc.). For further details we must refer to the interesting original.

Dr. Josef Paneth brings a new contribution[1] to the solution of the vexed question whether the cortex cerebri of new-born animals is irritable. He attributes Toltmann's negative results, which are accepted in most text-books, to the use of narcotics by that experimenter, and reports thirteen experiments made by himself on dogs, of which eight gave a positive, four a probably positive, and one a negative result. It may be added that animals which are born more advanced in development (as, for instance, guinea-pigs) have been already shown to have an irritable cortex at birth. The only irritable area was half a square centimetre in the region of the sulcus cruciatus. Microscopical examination showed the absence of medullated fibres in this region, so that Toltmann's view that their presence is essential to irritability is not sustained. Paneth's results agree with those previously reached by Lemoine.[2]

C. S. MINOT.

GEOLOGICAL SURVEY OF CANADA.

THE Dominion of Canada embraces nearly half the continent; but the greater part of this vast area is still a trackless wilderness; and the labors of the geological survey, in its earlier decades, were wisely concentrated upon those districts in the eastern provinces and the valley of the St. Law-

[1] *Untersuchungen über die physiologie des froschhirns.* Von Dr. J. STEINER. Braunschweig. *Vieweg*, 1885. 8°.

[1] *Ueber die erregbarkeit der hirnrinde neugeborener hunde.* Von J. PANETH. *Pflüg. archiv f. physiol.*, xxxvii. 202.

[2] Lemoine, *Contribution à la détermination et à l'étude expérimentale des localisations fonctionelles encéphaliques.* Paris. 1880.

rence which are and must always remain the chief seats of population and wealth, and an accurate knowledge of which must therefore always be of prime importance. This result is now in a large measure accomplished; and meanwhile the external conditions have greatly changed. The Canadian Pacific railway has connected the Gulf of St. Lawrence with the Gulf of Georgia, and flourishing communities have arisen in British Columbia and Manitoba. With this tide of immigration and development in the far west has come not only the possibility, but the necessity, of greatly extending the field and changing the plan of the survey. The outlines of the geology of a vast region are being rapidly traced, while the elaboration of details is mainly left to the future, save where there is promise of important economic developments.

The 'Report of progress of the Canadian geological survey for 1882-84,'[1] includes, besides the summary report of the director and two contributions from the chemist of the survey on the composition of the coals and lignites of the north-west territory, and various building stones and ores, thirteen separate reports on explorations, in nearly as many different sections of the dominion. These are arranged in geographical order, beginning in the far west; and it is therefore especially surprising to find that the first report was written twenty-five years ago, though now published for the first time. This is an account of the geology of the country near the 49th parallel, west of the Rocky Mountains, by Mr. H. Bauerman, geologist to the boundary commission. The publication of these rather antiquated observations seems to be justified by the fact that they largely relate to districts which have not been covered by more recent explorations.

This is followed by the most important of recent contributions to Canadian geology; Dr. G. M. Dawson's final report of 170 pages, on the region of the Bow and Belly rivers, embracing an area of about 27,000 square miles of prairie and plateau country lying in the angle between the United States boundary and the eastern base of the Rocky Mountains. This district, which touches the paleozoic rocks of the mountains, and is based on the cretaceous and Laramie formations, is the first in the north-west territory of which a systematic and proximately complete examination has been made, and is of special importance in consequence of the proximity of the valuable coal and lignite deposits to the line of the Canadian Pacific railway. These are shown to be wide-spread and practically inexhausti-

[1] *Geological survey of Canada. Report of progress for 1882-84.* ALFRED R. C. SELWYN, director. Montreal, *Dawson*, 1885. 8°.

ble; and the main geological features are so clea easily read, that, although the details are la left to the future, the present report and map be found adequate for a long time. The tre character of the plains is in a large measure c by the fossil fuels, but their aridity is not mitigated. That the climate has become in post-glacial times, is very plainly indicate the broad, deep drainage channels know *coulées*, which were evidently formed by rivers, but are now dry, or nearly so.

Dr. Robert Bell's report on the Athabasca gives the results of a rapid geological reconnais of the valley of that stream from the 55th pa to Lake Athabasca. We have here the first def information concerning a geological section, w like that on the Bow and Belly rivers, is ch remarkable for its simplicity and its promise o portant economic developments. It consist cretaceous marls and sandstones resting hori tally but unconformably on horizontal bed Devonian limestone; and the lower part of cretaceous is, over an area of thousands of sq miles, supersaturated with asphaltum and p leum. In no other extensive petroleum- probably, are the conditions so simple and so cl exposed as here. It is very much as if the thousand feet of barren rock covering the oil-s of Pennsylvania were removed. In the Athal field, too, the much-vexed question of the o of petroleum seems to find a ready solution, facts affording substantial support to the th that the oil has its source in the underlying stone, which is distinctly oleiferous.

Dr. Bell also accompanied the expedition out in 1884 to establish meteorological statio various points in Hudson's Strait and Bay. he enjoyed no special facilities, and the desu observations here published are all that could been reasonably expected, even from so experie an observer, especially considering that he wa only the geologist, but the zoölogist, bota taxidermist, photographer, and medical offic the expedition. The glacial phenomena, past present, received most attention; and the inte ing fact is established that the top of the c range of Labrador projected above the ice-s and was not glaciated. This report is ac panied by lists of the plants, mammals, birds, tacea, marine invertebrates, and lepidoptera lected.

Professor Laflamme's observations on the uenay have so greatly extended and multiplie known areas of Trenton limestone as to su that this rock may once have covered the La tian highlands continuously from the St. Law to Hudson's Bay, this part of the continenta

cleus having been completely submerged by the sea of that period. But it must have been dry land previously, since no traces of the Chazy, calciferous, and Potsdam are found beneath the Trenton, which rests directly and horizontally upon the Laurentian gneiss, and is so related to the present elevations and depressions of the gneissic surface as to indicate that they are in large part the result of erosion in pre-Cambrian times.

The reports by Messrs. Ells and Low on the Gaspé Peninsula, with the maps, indicate considerable progress in the elucidation of this small but very formidable wilderness; and Mr. Ells's notes on the geology of Prince Edward's Island prove that the so-called triassic beds of this island belong almost wholly to the Permo-carboniferous.

Prof. L. W. Bailey continues his investigation of the geology of New Brunswick in a report on Carleton and York counties, which is devoted chiefly to the Silurian and supposed Cambro-Silurian strata. The latter consist mainly of highly crystalline gneisses and schists; and the only evidence of their Cambro-Silurian age consists in the fact that they are overlain unconformably by the Silurian beds, coming between the latter and the great granite axis, by which it is supposed they have been metamorphosed.

Mr. R. Chalmers describes at considerable length the interesting glacial phenomena of the same region.

Mr. Hugh Fletcher's extended report on the northern and hitherto unsurveyed portion of Cape Breton, with the accompanying map of the whole island, places the geology of this province on a par with that of the rest of Acadia. The scale of the map, which covers 24 sheets, is entirely too liberal, being at least twice as large as either the topographic or geologic details require; and the bulkiness of the map seriously diminishes its usefulness, especially in the absence of a general map of the island on one sheet.

The remainder of the volume is made up of detailed reports on the apatite mines and deposits of Ottawa county, and the gold mines of the Lake of the Woods, and some scattering observations on the mines and minerals of Ontario, Quebec, and Nova Scotia.

HEIGHT IN FRANCE.[1]

IN the accompanying map of France the average height of the inhabitants is indicated by the shading, in which the darker shades denote the smaller, and the lighter shades the greater heights. It will be seen that a line, as shown on the map, running diagonally from Manche in the north-west to Savoie (Lyons) in the south-east, divides the country into two parts. To the north-east of this line the inhabitants are above the average height; to the south-west of it, below the average. This phenomenon was known to Broca, who ascribed it to racial influences alone. He held that the Celts and the Cymri mentioned by Caesar were the racial ancestors of the present French people. The Celts were of mean height, and were further distinguished by their round heads and bulging foreheads, and light hair and eyes; while the Cymri (or Belges of Caesar) were tall, and had long heads, with broad, high foreheads and light hair and eyes. Broca had also pointed out that unusual deviations from the average height were more common in those regions which we may regard as the country of the Celts, and rare among

the Cymric people. Broca prepared his map according to the frequency of the deviations from the average height, and his result is quite similar to what is obtained when, as in the present instance, the average height itself is the basis of comparison. In both cases France is divided by a line from north-west to south-east into two parts, the inhabitants of one of which are markedly taller than those of the other, while about the same regions appear as the extremes either of tallness or smallness in both cases.

It is well known that if the height of a large number of men are taken, and the number of men at each height be recorded, the largest number of records will centre about the mean height of the whole group, and the number will grow smaller as we leave the point of average height to either side. It is further known that the frequency of the records at each point of the scale is determined by

[1] From the *Revue scientifique*, October, 1885. By M. JACQUES BERTILLON.

the probability curve. The applicability of this curve to the representation of height has been frequently tested, and is found always to hold wherever the conditions upon which the law depends are present; viz., that variations in the phenomenon in question be due to a large number of causes, no one of which has any great effect. Where the law does not hold in the case of a series of heights, the probability is strong that there are some influences in question which cause a considerable variation in the average height. In several parts of France there is a strong indication of the existence of two types, distinguishable by their difference in height. If we draw the curve of height for these portions, this phenomenon is evident. A good example is shown in the department Doubs. The top of the curve for this region is M-shaped, while, in dealing with a case in which the probability case does hold, — that is, when a single type is present, as in La Creuze, — the top of the curve resembles an inverted V. There exist, then, in all the provinces in the north-eastern half of France, two types which can actually be separated from each other. This is shown on the map by the occurrence of pairs of smaller circles; and the ratio of the size of these circles indicates the proportion of the two types in each part. The average height of the tall type is 5 feet 6.6 inches; of the other, 5 feet 4.6 inches. It is certainly a curious fact that these two peoples, who now have every thing in common, — language, mode of life, and all, — who intermarry freely, and probably have no consciousness of their dual origin, should still be unidentified by the constant characteristic of a difference in height.

It is probable that other circumstances than those of race can affect the stature of a people. Chief among these are, 1°, the well-being of the community; and, 2°, pathological conditions. There are countries where the average stature has changed without the introduction of a new racial element. In the low countries (Holland, etc.) this phenomenon is ascribed to the effect of the draining of the marshes, and the general betterment of the people.

The statistics of Saxony, from 1852 to 1854, make possible a comparison between the heights of the liberal and the laboring professions. If we draw the curves representing the number of each class at each height, the curve for the liberal professions shows a superiority of height throughout. They have fewer short persons, and more tall ones. The difference between the two, however (5 feet 5.6 inches and 5 feet 4.25 inches), is smaller than in the case of racial difference.

A case in which pathological influences (such as cretinism) seem to be active is offered in Switzerland. Here there seems to exist a true type of dwarfs whose heights centre about 4 feet. The suggestion that minor influences such as these may also be active in producing the differentiation of height in France, is worthy of consideration.

THE EXTRACTION OF SUGAR FROM SORGHUM AND SUGAR-CANE.

The experiments in the application of diffusion and carbonatation to the extraction and crystallization of sugar from sorghum, which have been in progress under the direction of Dr. H. W. Wiley and his assistants at Ottawa, Kansas, during September and October, have been described by him in Bulletin No. 6 of the chemical division of the department of agriculture. The difficulties met with were largely of a mechanical nature, or resulting from the effects of early frost injuring the quality of the cane which was used for the experiment.

Of the trial on Oct. 8, Dr. Wiley says that during a run of about 21 hours, 70 cells, of about 1400 pounds of cane apiece, or 49 tons, were diffused, giving from 65 cells 96,140 pounds of juice. The exhausted chips contained less than 2 per cent of sugars, and the waste waters about the same amount; so that the extraction may be said to be nearly complete. The cost was about 80 cents per ton, and, with improvements in the mechanical details of the apparatus, labor and fuel can be saved, and the cost reduced to 30 cents. The juice drawn off stood to the cane chips in the ratio of 110 : 100 in the first, and 95.3 : 100 in the second, part of the experiments. The solids it contained varied from an average of 1.024 per cent, corresponding to a specific gravity of 1.0394 at 25° C., in the first half, to 10.55, corresponding to 1.0405 at 25° C., in the second half, of the experiment.

The juice corresponding to 15 tons of cane was defecated by the method of carbonatation, and yielded 4320 pounds of *masse cuite*, containing 77 per cent of solids, or a little more than 14 per cent of the cane worked. This, on being 'swung out,' yielded 1420 pounds, or 30 per cent of sugar well washed and dried, polarizing about 98 per cent, or at the rate of 95 pounds to the ton. The yield of second sugars would, of course, increase the rate of production per ton. Allowing 12 pounds to the gallon for the *masse cuite*, the number of gallons per ton would be 24, which is far in excess of the amount usually produced.

Dr. Wiley's general conclusions are as follows: —

1. By the process of diffusion 98 per cent of the sugar in the cane was extracted, and the yield was

fully double that obtained in the ordinary way. 2. The difficulties to be overcome in the application of diffusion are wholly mechanical. 3. The process of carbonatation for the purification of the juice is the only method which will give a limpid juice with a minimum of waste, and maximum of purity. 4. By a proper combination of diffusion and carbonatation, the experiments have demonstrated that fully 95 per cent of the sugars in the cane can be placed on the market either as dry sugar or molasses.

PROGRESS IN METALLURGY.

ONE of the serious metallurgical problems of today is the recovery of the by-products from the manufacture of coke by the destructive distillation of bituminous coal. In this country coke for metallurgical purposes is prepared almost exclusively either in open heaps or in 'beehive' ovens, — hemispherical fire-brick chambers into which sufficient air is admitted to burn the distillates, and thus to produce the heat required for the distillation itself. Not only are the distillates, which contain ammonia and tar, of great value to the color-maker, thus wasted, but, as they burn in actual contact with the coking mass, much (often twenty-five per cent) of the coke itself is incidentally burned. Both these evils are completely avoided by coking in retort ovens, heated externally by the combustion of the distillates, but after they have deposited their tar and ammonia in surface condensers. The first volume of the Journal of the Iron and steel institute, for 1885, contains an important group of papers and discussions on this subject, whose net result is to place the advocates of retort coking in a much stronger position.

The iron blast-furnace is the chief consumer of coke; and though in continental European blast-furnaces (and in British foundery cupolas as well) retort coke is as efficient as beehive coke, and though the calorific powers of the two fuels are almost identical, yet in British and American blast-furnaces the efficiency of retort coke has hitherto proved so low as to largely offset the advantages of the retort, — its greater yield of coke and its recovery of by-products. Hence the retort has gained but a slight foothold in these countries, though used on the continent very extensively and successfully with coals of widely varying compositions and properties. We may solve the retort problem either by adapting our retorts to the requirements of our coal, or by adapting our blast-furnaces to the requirements of retort coke.

Mr. J. Lowthian Bell shows by conclusive experiments that the low efficiency of British retort coke is due to its ready solubility in the carbonic acid which it encounters on entering the blast-furnace; and this, in turn, appears to be mainly due to the comparatively low temperature of retort coking. It would seem practicable, however, to raise this temperature approximately to that of the beehive; and Mr. H. Simon and Mr. Watson Smith describe the adaptation of the Siemens regenerative system to the retort for this purpose, and the improvement in the quality of the tar which it has effected. The problem of adapting the retort to the coal seems thus in a fair way to solution, while that of adapting the blast-furnace to retort coke appears to be in an equally promising condition, if we may judge from comparative tests which Samuelson describes, conducted on a gigantic scale in his blast-furnaces, themselves highly efficient, in which British retort coke shows an efficiency equal to that of the best beehive coke. This one success outweighs in importance fifty previous failures.

A very important contribution to the world's supply of tar and ammonia is promised from another source. A large and constantly increasing proportion of our metallurgical furnaces are heated by gas produced by the simultaneous distillation and partial combustion of bituminous coal and similar substances. In the apparatus employed the hydrocarbons, etc., arising from distillation, incidentally become diluted with such enormous volumes of nitrogen and carbonic oxide from the partial combustion of the coal, that the condensation of their tar and ammonia would require apparatus of a size and cost which are simply prohibitory; and, unable to separate these valuable substances, we burn them in enormous quantities. But Mr. John Head describes an egg of Columbus which promises to enable us to isolate the distillates for condensation and the manufacture of illuminating-gas.

A knowledge of the relations between the chemical composition and the physical properties of iron, which would enable us to infer the latter from the former, would be invaluable: unfortunately investigation has thus far only plunged these relations into hopeless confusion. To elucidate the subject, Dr. Hermann Wedding has carried out extensive and ingenious microscopic studies of the structure of iron. We have not space to analyze the results which he here presents, further than to give as a sample his announcement that malleable iron, produced by any fusion process, consists of two distinct components: 1°, minute porphyritically distributed crystalline particles; and, 2°, a homogeneous matrix in which they are distributed.

omes up for discussion, the number some-ing very large, as in Chromodoris with its ies. The remarkable new genus Bathy-redged in mid-Pacific at depths of 14,550 described at great length, and elaborately

family Onchidiadae — 'modified shell-less ates,' resembling in form certain nudi-ates — are treated of in an appendix, with l and critical notes. Bergh believes that pical seas, though hitherto but slightly l for nudibranchiates, will ultimately prove e headquarters of this group. The absence of s to American work emphasizes the fact, pretty well appreciated on this side of ntic, that in the study of this group there xcellent opportunity for some one of our naturalists who has not yet chosen a r.

venerable George Busk prints part i. of rt upon the Polyzoa (part xxx. vol. x.), reats of the Cheilostomata, enumerating cies from the Challenger's work, of which escribed as new. The workmanship of the in the author's own peculiar style of excel-There are nearly a thousand figures, and the evoted to an explanation of terms used in ion are especially acceptable. The general ions arrived at by Mr. Busk are evidently d for the second part of his report. The hical and bathymetrical distributions of the re treated at great length, and illustrated instructive map. Four species of Polyzoa ken by the Challenger in the North Pacific lepth of 3,125 fathoms; and one of these, a monoceras, was taken in the Australian t a depth of 35 fathoms, — an instance of e range in depth unparalleled elsewhere.

oek's report upon the Cirripedia (part xxv. .; part xxviii. vol. ix.), although the au-urns that his studies upon the deep-sea l have not yielded results equal to his icipations, is a very important contribution gy. It is printed in two parts, and is of concisely stated observations and preg-iticisms. It is an excellent example of the y work which the naturalists of the Nether-ave of late been producing, and is no un-continuation of the classic memoir upon e subject published a third of a century Darwin. The systematic portion of the is devoted entirely to the description of the ger's collection, but in the introduction is critical review of all that has been dis-or written concerning the group since the Darwin, and also a new zoögeographical ment of all known species.

One of the most surprising of the recent reports is that by Dr. von Graff upon the Myzostomida of the expedition. Fifty-two of the 68 species discussed appear here for the first time. In fact, all the known species of the group have been brought to light by Dr. von Graff, with the exception of three described by Leuckart, by whom the genus Myzostoma was first discovered. These very remarkable animals, by Dr. von Graff placed among the arachnids, by other authorities among the worms, near Tomopteris, and only found parasitic upon and in crinoids, are being found in all the zoölogical collections, now that attention has at last been directed to their very inconspicuous existence. Twenty-two species, 14 of them new, are attributed to the explorations of the U.S. steamers Bibb, Hassler, Blake, and Corwin. A concise account of what is known concerning the Myzostomida serves as a preface, and there is a curious colored diagrammatic figure printed in with the text. The lithographic plates are exquisite.

In a second paper upon the Entomostraca (part xxiii. vol. viii.), Dr. G. Stewardson Brady treats of the Copepoda. His paper is mainly descriptive, and is, of course, prepared in his usual scholarly manner. There are 55 plates, diagrammatic and useful, but not artistic; and 142 pages of text, treating of 90 free-swimming species, and 15 fish parasites obtained by the Challenger, only one of which, Pontostratiotes abyssicola, dredged in a depth of 2,200 fathoms, is undoubtedly a deep-sea species.

The report upon the calcareous sponges, by Professor Poléjaeff of Odessa, a pupil of Schulze's, enumerates 30 species, 23 of which are new. A considerable portion of the paper is devoted to destructive criticism of the previous work of Professor Haeckel, and the construction of a new 'natural classification' of the group. There are four superb plates of white sponges upon black backgrounds, as well as a number of anatomical figures beautifully drawn by the author.

Mr. Henry B. Brady's ponderous memoir on the Foraminifera, in two volumes, — one of text, 814 pages; and one of illustrations, 115 plates and at least 2,000 figures, — is really a monographic revision of the entire group, with an exhaustive bibliography, from the year 1565 to the present time, and a chapter on classification, historical, critical, and constructive, leading up to an elaborate synopsis of families and genera. The synonomies and the tables of geographical distribution are made up in a very workmanlike manner, and the index is a delight to weary eyes.

The animals of this group are distributed everywhere over the ocean-bottom, as well as at the surface and in mid-waters. The presence or ab-

sence of the calcareous shells of some of the pelagic species at different depths and in different localities is connected with some of the most important problems in oceanography. It was of the greatest importance that all questions relating to geographical and bathymetrical distributions should be discussed with reference to a thorough understanding of the relations of all existing forms; and it was, indeed, a fortunate thing that a naturalist so familiar with the Foraminifera as Mr. Brady should have undertaken this work.

Mr. Brady, referring to certain views held by Dr. Wm. B. Carpenter and his colleagues concerning the existence or non-existence of true species amongst the lower Protozoa, which are, he admits, "from a purely biological stand-point, for the most part incontestable," holds that they really embody only one aspect of the subject. Although in some families, not merely reputed species, but reputed genera, are connected by a close array of intermediate modifications and dimorphous forms, and all sharp demarcations have ceased to exist, in others the successive modifications appear to be less closely connected, and to possess distinctive characters of greater persistence. "Admitting," he writes, "the intimate relationship which often prevails throughout an entire generic group, admitting even that all the members of a genus may be referred to a common ancestral type, the question still remains how the different terms of each series are to be recognized. The various modifications which have been referred to differ not merely in details of form and structure, but in habit. They are met with under diverse conditions as to latitude, depth of water, nature of sea-bottom, and the like, and their modes of life are often totally distinct; furthermore, fossil specimens, with similar peculiarities, appear to have existed under precisely corresponding circumstances. Whether 'species' or not, the more important of them possess characters which afford means of easy identification, and it is obviously necessary that they should be provided with distinctive names." He admits the value, as a method of study of the plan proposed by Parker and Jones, in their memoirs on North Atlantic Foraminifera, of grouping the almost endless varieties of the Foraminifera around a small number of typical and sub-typical species, but denies that this plan may be made a basis of nomenclature. The binomial system must be retained, and it is impossible to deal with the multiferous varieties in this group without a much freer use of distinctive names than is permissible among animals endowed with more stable characters.

The chapter on the chemical composition of the tests of the Foraminifera possesses considerable interest in connection with the study of b deposits. That upon pelagic species wou much more satisfactory to the reader if r more definite conclusions could have been att by the author of the memoir in a manner sat tory to himself.

Eozoon is admitted to a place in the syn but Mr. Brady does not commit himself t opinions. In the introduction to his bibliogr he states that many of the titles of the les portant contributions to the Eozoon contro are admitted. The American names in the ography are those of Isaac Lea, the earliest, S.G. Morton, J. W. Bailey, E. de Verneuil, J. Meek and Hayden, G. G. Shumard, W. M. (J. W. Dawson, Count Pourtales, J. P. White C. A. White, H. A. Johnson and B. W. Tho T. A. Conrad, Angelo Heilprin, and J. Leic

The publication of the results of the Challe is evidently being forwarded as rapidly as the tations of painstaking research will permit. much to be regretted that the French zoölo who have the work of the Talisman and Tra leur in charge do not profit more by this exan

G. Brown Good
U.S. national museum.

DROUGHT AND WEATHERCOCKS.

A writer in *Symons's meteorological jou* calls attention to a connection between dro and weathercocks. The connection does always exist. Some weathercocks are enti independent of drought or floods, and s are very seriously affected. The former those which do not carry any of the usual le N, E, S, W, or which are wholly of metal, carried on metal or stone supports. The weat cocks which suffer from drought are those w have the cardinal points indicated by the let and which (though themselves of metal) are ried at the summit of a tall pole. The pole, u the influence of sun and drought, splits, and cracks run nearly along its length, but not cisely. They are slightly inclined, and all parallel. If the drought is prolonged, they bec numerous, and, though no one crack may l tenth of an inch, the aggregate amount bec large. We have ourselves measured one which the letters were, during the July drou carried round 44°; the S letter was carried ar until it pointed almost exactly S.W. With sequent moisture the cracks have partly cl and possibly by November the letter S wil nearly back in its true position; but as to thi have no knowledge. It is evidently necessar observers to watch for the occurrence of somewhat strange error.

SCIENCE.

FRIDAY, DECEMBER 18, 1885.

COMMENT AND CRITICISM.

THERE IS A POPULAR BELIEF that demand begets supply. If this be true, it would appear that the demand for good maps and atlases of this country, on small scales, is very limited. In respect to culture, the published maps are fairly good, although in detail they are not what they should be, even in this respect. In their representation of natural features, however, they are, as a class, subject to severe criticism. It is not too sweeping an assertion to say that there is scarcely an atlas of this country which is abreast of our geographical knowledge, or even within several years of it. Indeed, in atlases dated '1884,' there are to be seen maps of the western states and territories, in which all geographical work, executed subsequent to the Pacific railroad explorations, has been ignored. The charitable might assume that the compilers were not aware of the existence of later and better material, were it not for the fact that in many atlases the same area is represented a second time by maps compiled from material of much more recent date. One must conclude that the same old plates have been made to do duty these many years, and that, while the culture has been revised from time to time, the natural features have not been considered of sufficient importance to warrant revision. On the most recent maps one still meets with the old familiar errors. The mouth of the Rio Dolores, in eastern Utah, is still frequently represented thirty miles out of place. The mythical island in Green River, in the Green River basin, is occasionally seen; and Sevier Lake, Utah, is sometimes accompanied by its double, the so-called 'Preuss Lake.'

But it is not in this respect alone that our maps and atlases are subject to criticism. As a rule, the representation of the relief is a dismal failure. There is scarcely a map published by private parties which gives even a fairly good picture of the orographic features of the country. No attempt is made, by means of contours, at a quantitative representation of relief, but hachures and crayon, or brush-work alone, are employed. In most cases the expression is in the highest degree conventional, a double line of hachures representing a range, and an asterisk a peak. When an attempt is made to represent properly the forms of relief, it is seldom successful. Through the ignorance of the compiler, the great ranges are belittled, while minor ridges take on an importance altogether disproportionate to their size. Every divide between drainage systems is represented as a mountain range. Plateaus appear as ranges, and ranges as plateaus. Another feature to be condemned is the raw and glaring colors by which the states, counties, etc., are distinguished from one another. If colors must be used, let them be subdued tints, which will not offend the eye, or render the map illegible. Many American maps and still more foreign maps are rendered almost illegible from the quantity of material which they contain. The names are so numerous as to obscure all other features, while the lettering is often so fine that it can be read only with a microscope. A map should be as legible as print. There is certainly room for improvement in the compilation and publication of maps.

IN THE INAUGURAL ADDRESS of President Adams of Cornell, reference is made to the need for the establishment of regular courses of instruction in the history and science of education at that university. According to the census of 1880, there are in the United States 64,137 lawyers, 64,698 clergymen, 85,671 physicians, and 277,710 teachers. For each of the first three professions we demand a more or less special training. Sometimes we ask much, sometimes little; but we always require something, and in the more cultured sections of the country that something is a great deal. With our teachers the case is, or it may be more just to say has been, radically and incomprehensively different. Any person who chose could start a school, and various influences aside from special training served to secure responsible positions in institutions of learning. Teaching may, and perhaps does, require what we are used to hearing called a knack. But on what principle is it that teachers are not required to possess a scientific knowledge of their

profession? That profession is not a fungus, but a gradual development. It has a history, it has a literature, and it has a profound philosophy. How many of our two hundred and seventy-seven thousand teachers know any thing of these? We are forced to believe that this number can be counted by hundreds, perhaps even by scores. Our great universities are the places where reform in this matter should be brought about. Let us see established in each of them courses of instruction in the history, theory, and practice of teaching. Let us hear something about the educational systems in other countries. Cambridge, Edinburgh, St. Andrew's, and other British universities have taken this step, and it has proved a successful one. It is no new thing in France; and such lectures are to be heard in almost every university in Germany. Paulsen in Berlin finds from two to three hundred hearers for his lectures on *pedägogik*, which occupy four hours per week throughout the semester. Our college presidents recognize our need in this respect, but the governing boards do not seem to carry out their recommendations. How much must be said and written on this subject before the authorities understand what is needed to round out this scheme of university education? It is safe to say that not more than three of our leading colleges now offer any scientific instruction in pedagogics.

THE GOVERNMENT AND ITS SCIENTIFIC BUREAUS.

Those who anticipated that the President, in his annual message to congress, would enunciate some radical views in respect to the relations of the government to its scientific work, have been disappointed. Those who know how sincerely desirous he is to uphold the efficiency of the public service have been gratified. Considering the length of his message and the obvious care which has been bestowed upon many questions, — the coinage of silver and the civil-service reform, for example, — it is noteworthy that all he has to say upon science is contained in a few short paragraphs. Two suggestions which he makes are, however, of very great importance, and deserve the most judicious consideration, — the separation of the signal service from the war department, and the transfer of the coast survey to the navy department. It is remarkable that these recommendations so opposed to one another should be included in one message, and it is by no means obvious why better administration can be secured in the one case by separating a large corps from the army, and in the other by placing a large corps under the administration of the navy. There are strong reasons for believing that both those bureaus — the signal service and the coast survey — will do better work if allowed to stand as independent corps, — that is, detached from the army and navy. The reasons for such a belief will doubtless be made known to the congressional commission which has been instituted for the investigation of this and allied subjects.

This commission, in continuation of the prolonged inquiries which it carried on several months ago, resumed its work, unless we are misinformed, within the first week of the session. It is earnestly to be hoped that all the matters which come within its view will be soon taken up, and such a report prepared as will enlighten the administration, congress, the men of science in the government service, and the public at large, upon the principles which should govern the various scientific bureaus established in Washington. These principles seem to us very clear, and we hope to see them so definitely announced during the present winter that subsequent legislation will be simplified, and future superintendence made more efficient than ever before.

It is already evident that the alarms which were sounded by some over-zealous correspondents during the last summer and early autumn were exaggerations. One important case of mal-administration was undoubtedly brought to light; but the more thoroughly that case is understood, the more obvious it is that the chief officer upon whom reproaches were cast has been long a sufferer from such serious physical infirmities, and that right-minded men should rather incline to charity than to censure in their estimate of the close of his official career. The full and frank explanations which were promptly made by other chiefs of scientific bureaus have removed the imputations which were cast upon their official conduct. It is not unlikely that congress will institute such inquiries as will reveal the exact situation, and we have not the least doubt that the utmost scrutiny will be encouraged by those whose work has been publicly impugned.

Out of all this discussion there will doubtless proceed further legislation in respect to the scientific work of the government, and probably better methods of administration will be devised than those which have hitherto prevailed. The danger

which are liable to come from the overlapping of responsibilities and the confusion of purposes can be obviated. Better modes of appropriating money can be devised, and better assurances can be given that those who devote themselves to the government service shall not be inconsiderately superseded. But we doubt whether any system will be adopted which will secure the services of an abler corps, or, on the whole, a more faithful corps, than that which has superintended and directed the governmental work in science during the last twenty or thirty years. Any country may well be proud of the investigations in geology, in geodesy, in geography, in astronomy, in meteorology, in natural history, and in ethnology, which have been performed within that period by a staff of civilians; and to all their achievements must be added the scientific researches and studies of the able officers in the army and navy.

Whatever measures may be adopted with respect to re-organization, one principle should constantly be borne in mind. Science cannot be carried forward by prescribing too definitely the tasks of scientific men. They may be bound by appointed days and hours; they may be told to perform specific duties, — and if only the maintenance of routine work is required, such regulations may secure fidelity and efficiency. But if knowledge is to be advanced, if better methods of work are to be discovered, if greater accuracy is desired, if unknown facts are to be ascertained and recorded and discussed, and, in short, if there is to be real progress, the methods of freedom are to be employed, not those of petty regulation. By this we mean that if the great undertakings which the government has in charge, if especially its surveys of the coast and of the interior, are to go forward, discretion must be given to the chiefs of bureau, and they must be held to accountability for the aggregate success of their work. Honesty, economy, clear and accurate statement of accounts, are, of course, to be demanded in every office: nobody questions this. But the determination of what shall be undertaken in a given year, to whom it shall be assigned, what allowances shall be made for instruments, books, and assistants, — these are questions which experience and judgment must decide. Somebody who has all the facts in mind must make the determination, and he must not be too quickly condemned, because the immediate results of the investigations which he has undertaken are not yet apparent. The highest personal character should be found in every one who is called upon to direct the labors of a scientific corps; he should be faithful, watchful, careful that all the interests intrusted to him may be promoted; but he should be free within the limitations of his office to select his subordinates, determine their duties, and prescribe their methods. Only by such regulated freedom as this can the highest results be obtained. Discretion with responsibility, in all the higher work of science, will bring the best services from those whose moral attitude is what it should be: no others should be intrusted with the leadership.

THE MEETING OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.

AFTER the paper of Dr. Hunt at the morning session, Tuesday, Dec. 8. (*Science*, Dec. 11), there was presented a paper on forms of tables for vital statistics, by Dr. J. S. Billings. Attention was called to the diverse forms in use throughout this country and Europe, and to the difficulties of drawing valuable deductions from a comparison due to this diversity. The health officer of a city desires information of the diseases which are liable to become epidemic, as to their location, relation to nuisances in the neighborhood, etc., in order that he may know where sanitary work is most needed. For this purpose tables are prepared which are made the basis of his study. These tables are published in the forms of bulletins or reports. Of these there are three principal forms: the weekly, the monthly, and the annual. As ordinarily issued, the weekly bulletin is too elaborate: its proper office is that of warning. If delayed, as it must be if complete and perfect statistics are to be recorded in it, its very object is thwarted, and its warning voice is not heard until after the need for it has passed. The annual form should be complete, and any reasonable delay in its issue to accomplish this is no detriment. The weekly bulletins issued by boards of health have too much the character of an annual report. It should constantly be borne in mind that they are designed for the information of the people: their main purpose is educational. They should state the total deaths, by color, sex, age, and locality; also those for certain diseases, as phthisis, pneumonia, cholera, yellow-fever, and diphtheria. In this form the unit of area is political usually, as by wards. This ward division could oftentimes with advantage be abandoned, and some other unit substituted. It is sometimes very important to have the mortality recorded by blocks, and the deaths which occur in a single tenement-house may not

infrequently be made the subject of special mention in a published report, with great advantage to the public health. The forms of cities, both American and European, were referred to as showing their great diversity. It would be better for the health officer to study the returns, and then publish through the secular press his deductions and observations. This could be done promptly, and would be of great benefit. There could then be issued a monthly bulletin, which could be made as complete as was desirable, and these monthly tables together would form the annual report. In the weekly statement to the public there should be no concealment: it should be frank and full as to the existence of communicable disease. Business interests should not be permitted to stand in the way of a free statement as to the existence of diseases liable to become epidemic, as by so doing time for preparation and protection by neighboring localities would be lost. The graphic form, as by diagram, was heartily commended as a means of education of the people, showing at a glance facts which would otherwise require hours of study. It was suggested that there be a conference of public officials having in charge these matters of vital statistics, to devise a plan by which there might be greater uniformity in the forms of tables and reports. Subsequently a committee was appointed, with Dr. Billings as chairman, to present to the association, at its next meeting, forms for the weekly, monthly, and annual bulletins.

In a paper on the relations of rainfall and water-supply to cholera, Dr. Henry B. Baker, secretary of the state board of health, Lansing, Mich., showed that the best plan to study cholera is in its home, and that if we can find any means by which its ravages have been diminished there, we may reasonably infer that the same measures adopted here will produce a similar result. With this object the history of cholera has been studied in India, with the most striking results. Six tables and diagrams have been prepared to make the subject more intelligible. Prior to 1869 surface or tank water was in use in Calcutta. During the five years 1865–69 the average deaths were 4,388 annually, in 1866 being 6,826, and in 1867, 2,270. In the year 1869 provision was made for a supply of filtered water, and in 1870 a most remarkable change was noted; the deaths in that year from cholera being only 1,558, and in 1871 falling to 796. Since 1870 there has been a marked reduction, estimated at 3,000 per annum. It was also demonstrated that during the seasons of the year when there was little rain the mortality increased, and that when the rainfall was most abundant the disease declined, even in the hottest weather. During the heated period there were 300,000 more gallons of water sent into the city, and consequently less of the tank-water used, and just in that proportion was the mortality diminished. The year 1880 was remarkable for its low mortality, there being in that year but 805 deaths. The rainfall for that year was six inches greater than the mean for forty-eight years. In the suburbs the same improvement has not been noticed. This is explained by the fact that the tank-water is still in use there. A sewerage system was devised for Calcutta in 1859, to cost $4,000,000. Thus far $3,100,000 have been expended. The following deductions may be drawn: 1. The mortality for cholera has been reduced two-thirds by the introduction of filtered water. 2. Both before and since its introduction the rainfall has exercised an important influence on the mortality. 3. If the disease has been reduced two-thirds through the improved water-supply, and if one-third depends upon the amount of rainfall, this latter might be still further reduced by increasing still more the supply of good water, so as to make the people independent of the tank-water. 4. If in the home of cholera these agents have produced such beneficial results, we have every reason to believe that similar results would follow a like course pursued elsewhere.

'The virus of hog cholera,' was the title of a paper by D. E. Salmon, D.V.S., Washington, D.C. Of all the diseases which affect animals in this country, none is more destructive than hog cholera. During the present year it has been unusually prevalent, having appeared in almost every state in the union. It has caused a loss of thirty million dollars. While it has never been shown that it is communicable to man, yet indirectly he is affected in other than financial ways. What becomes of the millions of carcasses of the animals succumbing to the disease? Large numbers are thrown into ponds and streams from which drinking-water is obtained, there to putrefy; others are converted into lard; while but a very small proportion are burned or buried. Oftentimes, when these animals first show symptoms of sickness, they are despatched as quickly as possible to market, and there slaughtered, and their meat put up by the packers. The effect of such meat upon the health of human beings is uncertain.

The questions connected with the virus of this disease are exceedingly interesting. The entire subject of contagion is very much elucidated by its consideration. Anthrax is an endemic or enzoötic disease, rather than an epidemic or epizoötic. Fowl cholera is not limited by area or soil, but is not disseminated to a distance: it must be taken in the food or inoculated. Hog cholera, on the other

hand, is disseminated through the air to a considerable distance: some claim that this may be as much as half a mile, but this is probably exaggerated. The disease known in France as 'rouget' is supposed by some to be identical with our swine plague or hog cholera. Its virus is a long and slender bacillus. Pasteur's vaccine contains this bacillus, and not the figure-of-eight form which he first described. The 'rothlauf' of Germany is characterized by a fine bacillus, apparently identical with that of Pasteur's vaccine. In rothlauf the period of incubation is shorter than in swine plague; and another difference is absence of ulceration of intestine. The author inoculated four hogs with Pasteur's vaccine: one died; the three others survived, but, when they were subsequently exposed to our hog cholera, they contracted it, and died. It is evident, therefore, that the rouget of the French, and the hog cholera of the United States, are different diseases, and that to introduce into this country general vaccination with Pasteur's vaccine would not protect our swine against cholera, but would introduce a new disease, and result in great loss and injury.

In the discussion which followed, Dr. Salmon stated, that, in his opinion, the virulence of the disease did not depend in any great measure upon the sanitary conditions with which the animals were surrounded. It was as fatal at the experimental station in Washington, where the most rigid cleanliness was practised, as elsewhere.

At the evening session on Dec. 8, Dr. James E. Reeves, the president, delivered the annual address. He especially called attention to some glaring deficiencies in the national organization. Congress had made no provision for the study of the causation of diseases that carried off tens of thousands of the people every year, and to-day we are compelled to submit to the mortification of having our children taken to Paris, where a Frenchman, Pasteur, has the only means which can save their lives. His address was an earnest plea for help to establish such a biological laboratory as the country could take pride in, for the investigation of human diseases with reference to their causation and prevention. He also deprecated the weakened condition in which the National board of health had been placed by the withdrawal of funds.

An account of the small-pox in Canada, and the methods of dealing with it in the different provinces, was given by Dr. P. H. Bryce, secretary of the Provincial board of health, Toronto, Ontario. In 1884 the town of Hungerford was visited by small-pox. Before a knowledge of its existence there was obtained by the board of health, one hundred and fifty persons were attacked; and yet so vigorous were the methods adopted to control it, that within two weeks the last case occurred. In April of the present year two cases occurred in Montreal: one was taken to a house in the city, and gave no further trouble; the other was removed to a general hospital, the Hôtel Diéu, and soon there were nineteen cases, of which seven were fatal. From this the disease spread, so that in April there were 6 deaths: in May, 10; in June, 13; July, 46; August, 239; September, 660; October, 1,391; November, 633. In all, thus far, there have been three thousand deaths, in about five hundred different houses. From the city it spread to the suburbs, where it is now prevalent. In order to prevent the introduction of the disease into Ontario, the board of health of that province sent inspectors into Montreal, and every passenger and his baggage were inspected before they passed the boundary-line between the provinces. Rags were prohibited under all circumstances, and other goods were admitted only when accompanied by the certificates of these inspectors that they were not infected. Vaccination of all unprotected persons was enforced. Although the disease was so prevalent in all the eastern parts of Canada, yet but fifteen cases have occurred in the entire province of Ontario, and not one case from infected baggage, merchandise, or clothing,—a far less number than have occurred in the city of New York in the same period, distant as it is from the centre of infection. One case had been traced to a letter.

Dr. Hingston of Montreal explained at some length the difficulties which the health officials had had in their attempts to stamp out the disease in that city. Some thirteen years ago anti-vaccination documents began to be circulated in the French language, and this has continued ever since. Every vaccination followed by any inflammatory trouble was denounced as an outrage, the inflammation denominated erysipelas, and the child declared to be poisoned. As a result of this agitation, but few of the French Canadians born during the past thirteen years were vaccinated, and it was among them that small-pox has found its victims.

'Impure air and unhealthy occupations as predisposing causes of pulmonary consumption,' was the title of a paper by Dr. C. W. Chancellor, secretary of the State board of health, Maryland. Consumption causes one-fifth of all the deaths in England, one-sixth in France, one-seventh in Germany and Austria, and one-eighth in the United States. In 1880 the total deaths in this country from all diseases was 756,893. Impure air in rooms where tailors and seamstresses worked all day, with closed windows and no means of venti-

lation, resulted in consumption in these people. In the country, consumption prevails in damp valleys and along the banks of rivers. In the city we find it most prevalent in those whose habits are sedentary, as book-keepers, clerks, salesmen, etc. It is also prevalent among file-makers, steel-workers, grindstone-makers. In the latter class, hardly one escapes. In the discussion of this paper, it came out that the mortality from consumption was greater in the District of Columbia, in proportion to its population, than in all of New England; and that whenever it occurred it was largely acquired, probably seventy-five per cent. In fact, some, Dr. Didama of Syracuse among the number, believed that it was always acquired, and never hereditary.

The evening session of Dec. 9 was opened by the reading of a paper on 'The German system of physical education,' by Dr. E. M. Hartwell, Johns Hopkins university, Baltimore.

Physical training had its origin in Germany in 1785. At present the time devoted to this part of the education must be at least two hours weekly. The effect on the development of the German youth can be imagined when it is considered that this systematic physical training continues from the age of six years to the age of eighteen in girls, and twenty in boys.

A full list of the papers was given in *Science* of Nov. 20.

The Lomb prizes were awarded as follows:—

1°. 'Healthy homes and foods for the working classes.' First prize not awarded; second, to Victor C. Vaughan, Ann Arbor, Mich.

2°. 'Sanitary conditions and necessities of school-houses and school-life.' First prize not awarded; second, to D. F. Lincoln, M.D., Boston, Mass.

3°. 'Disinfection and individual prophylaxis against infectious diseases.' First prize, to George M. Sternberg, M.D., surgeon U.S.A.; second not awarded.

4°. "The preventable causes of disease, injury, and death in American manufactories and workshops, and the best means and appliances for preventing and avoiding them." First prize not awarded; second, to George H. Ireland, Springfield, Mass.

Reports of committees on school hygiene, animal diseases and animal foods, and on disposal of the dead, were made by their respective chairmen. The latter was a *résumé* of what had been accomplished during the past year in the advancement of cremation. The 4,380 human bodies which are dissected annually in Paris at the medical school are now cremated in the cemetery of Père la Chaise. In Italy there were, during the year 1884, 396 bodies incinerated. In Spain a bill has become law, granting permission to cremate human bodies. In Germany, in 1884, 186 bodies were similarly disposed of. During the present year four persons have been cremated in England, and there is now no question there of the legality of this process. The agitation of the question has aroused the Church of England, and important reforms have been instituted in the methods of burial. One of these is the substitution, for the usual coffins, of those made from pulp or *papier-maché*, which will readily disintegrate. In France a bill is now in the chamber of deputies, legalizing cremation, and an engineer has been sent to Italy to study the best plans for a crematorium, to be built near Paris. During 1884 six societies for the advancement of cremation have been established in the United States, and two crematories erected.

Mr. Lomb offered new prizes for another year, one for plans for constructing houses costing $600, $1,000, and $1,500; the amounts to be $100 for the first, $75 for the second, $50 for the third, and $25 for the fourth.

The following officers were elected for the ensuing year: president, Dr. H. P. Walcott, Cambridge, Mass.; first vice-president, Dr. C. W. Covernton, Toronto, Canada; second vice-president, Dr. G. B. Thornton, Memphis, Tenn.; treasurer, Dr. J. Berrien Lindsley, Nashville, Tenn. The secretary, Dr. Irving A. Watson, was elected in 1883 for three years.

It was decided to hold the next meeting at Toronto, Canada, commencing on the first Tuesday in October.

METHODS OF TEACHING POLITICAL ECONOMY.

Professor Laughlin opens the work which we have under consideration with these words: "The existence of this little book is due to an attempt to convey by lectures to students an understanding of the position which political economy holds in regard, not merely to its actual usefulness for every citizen, but to its disciplinary powers, and to the qualities of mind which are necessary for success in the study."

The author's treatment of methods, based as it is upon an experience of several years in the class-room, is valuable both on account of its positive information and its suggestiveness. It may be well, in particular, to call attention to those pages in which Professor Laughlin describes the advan-

The study of political economy. Hints to students and teachers. By J. Lawrence Laughlin, Ph.D., assistant professor of political economy in Harvard university. New York, *Appleton*, 1885. 12°.

he graphic method as a means of illus-
inciples and presenting statistical state-
e significance of which is understood
uch difficulty by the ordinary student.
Laughlin recognizes the utility of history
tics, but he treats them rather as means
ation and verification of what has other-
ascertained, than as the source of new
. Professor Laughlin also attempts to
hics and economics.
ure of the book is a 'teachers' library,'
on the whole, though omissions are no-
No history of the science is mentioned.
h a well-known and valuable work as
ogers' 'Work and wages' finds no place,
ame is true of the works of Wagner and
Communism and socialism, irrespective
lue of their theories, have assumed an
importance sufficient to demand a careful
their principles by teachers of political
; yet none of their leading exponents are
o. Under 'Reports and statistics,' the
ils to notice those valuable sources of
on, the reports of the state bureaus of
istics, as well as other valuable state pub-

ject of the book is good, and the work is
e addition to our too scanty literature on
t of method in teaching political econ-

NOTES AND NEWS.

PUTNAM'S SONS announce the publica-
monthly paper to begin January, 1886,
titled *The national argus*. This paper
voted to the discussion of questions re-
the care of the insane, the idiotic, the
dumb, the blind, paupers, and homeless

norgagni of Nov. 3 reports that Dr.
Rio Janeiro has inoculated more than
ndred persons with a liquid culture of
v-fever microbe. Such inoculations are
l with five or six punctures in one arm,
few hours afterwards the patient com-
headache and backache, with a slight
mperature. Nausea and vomiting occur
nses. These symptoms sometimes last
two and three days, but they are never
The inoculations are practised on indi-
ho were in the centre of the infected
None of them died, and only very few
mild forms of yellow fever.

— Lord Crawford cables, Dec. 16, the discovery by Gove of a new star, in the place of D. M. 20°, 1172, possibly a variable. It was of the 6th mag. on Dec. 13.

— Kane's 'European butterflies' is meant to replace Kirby's little manual published more than twenty years ago, and is, indeed, a much more complete work, with excellent illustrations of over 100 butterflies; but it is sadly deficient just where we most need help, and where Kirby did all that was then possible, for it pays no attention whatever to the early stages or food plants of these insects, any allusions to them being merely incidental. It is of value, therefore, only to a student of the old school, or the old-fashioned collector. In its details as to geographical distribution it is worthy of all praise.

— The Smithsonian institution has issued a price-list of its publications, which are no longer distributed gratuitously to individuals, as formerly; and no wonder, when they already exceed six hundred. The prices which have been affixed are high as compared to government publications in general, though an ordinary publisher would look on them as rather low. Considering the object of the institution, one is inclined to wish the prices had been made somewhat lower; and to attach any price at all to some of them, such as circulars, seems not worth the pains. Nearly a third of the publications are out of print, and therefore not embraced in the list.

— With the beginning of the coming year, the two leading meteorological journals — the Austrian and the German — will be consolidated, and will appear under the joint editorship of Drs. Hann and Köppen. The composite journal will be known simply as the *Meteorologische zeitschrift*. It will be published by Asher & Co. of Berlin.

— Dr. Latour's 'De la chaleur animale' (Paris, *Baillière*, 1885) may be described as an attempt by a person unacquainted with elementary facts in physiology and anatomy to explain the pathology and nature of fever. In reading it, one hardly knows whether to be amused by its author's *naif* self-conceit or to be exasperated by his impudence. As regards the color of the blood, we are informed (p. 13) that "it is only by mixture with carbonic acid . . . that this fluid takes the dark tint,—a tint which it gives up to resume its brightness so soon as this excrementitial gas has been rejected." It is hardly necessary to point out that the bright color of arterial blood is due to the fact that its coloring-matter is combined with oxygen; and the dark color of venous blood, to the fact that most of the haemoglobin has given up its oxygen, and that

the presence or absence of carbon dioxide has no direct connection with the phenomena in question. The well-established fact that by far the greater part of the oxidations of the animal body occur outside the blood-vessels and within the living cells and fibres of the tissues, is apparently quite unknown to our author. One hardly knows how to characterize the treatise: if written for the laity, it is charlatanry; if for pathologists and physicians, an impertinence.

WASHINGTON LETTER.

THE past fortnight has been a period of considerable activity, not to say anxiety, in the national capital. The pursuit of science withdraws men to a great degree from 'the madding crowd's ignoble strife,' and it is supposed to go on undisturbed and uninterrupted by affairs political or social. But the science of Washington is, in one way or another, almost entirely government science; and for its support, extension, contraction, indeed for its very existence, it must depend on the favor with which it is looked upon by a somewhat vacillating and fickle body of statesmen. The organization of a new congress is always a matter of much interest; but just now this is greatly enhanced by the consideration that the new body is to receive the first message from the head of a new administration, from which communication the attitude to be assumed by the ruling party towards science may possibly be inferred. This document has been before the public for several days, and comment is unnecessary; but it is not too much to say, that, in its references to the scientific work of the government, the general impression seems to be that it is not unsatisfactory on the whole, although in certain particulars it is not in agreement with the prevailing sentiment among scientific men.

The reports of cabinet officers are also looked for with interest, as they almost invariably contain recommendations, which, if carried out, affect the science of the government favorably or unfavorably. The reports just issued are, in the main, favorable to a liberal support of the scientific bureaus, and in one or two instances indications are shown of a disposition to correct certain evils which have long been recognized.

Under these circumstances, it is not surprising that scientific men should themselves be tempted to bestow more or less thought and attention upon the somewhat uncertain relation which they and their work bear to the government. The retiring president of the philosophical society, Prof. Asaph Hall, only incidentally yielded to this temptation in his address, delivered before the members of the society and invited guests, on the evening of Dec. 5. Professor Hall's topic was the scientific societies of America, and his treatment of it gave great satisfaction to his hearers. He spoke of the organization and history of some of the older and more important societies of the country, beginning, of course, with the American philosophical society, with Ben Franklin for its first president. The National academy came in for a good share of the discussion, and in this connection the general question of the relation of the academy to the government was considered, as well as that of the position of the 'government scientist.' He paid the society over which he has so satisfactorily presided the deserved compliment of declaring it to be first in importance among the local societies of America.

Only a few days later, the chemical society, a young and vigorous organization, listened to the address of its retiring president, Prof. F. W. Clarke. It was an able and entertaining *résumé* of the growth of chemistry in Washington during the past twelve or fifteen years, and it concluded with a plea for the establishment of a national laboratory, which, in its dimensions and equipment, should be commensurate with the importance and dignity of the science. Arguments to show the economy in and the necessity for such an establishment were not lacking, either in number or force. Examples of duplication or useless repetition of work, multiplication of instruments and facilities with no increase in efficiency, and frittering away time and energy on work properly belonging elsewhere, were given with a convincing emphasis, which made it a little difficult, at the close of the address, to believe that there were two sides to the question.

With the assembling of congress, the committee appointed by that body to report upon the advisability of a union of the scientific bureaus of the government has taken up its work again. Two or three meetings have been held, at which one or more officers of the signal corps have been examined. Most of the evidence obtained by this committee prior to the current session has been widely published, and read by many with much interest. It may be inferred, from the promptness with which the committee has begun the collection of testimony at the opening of the session, that it is desirous of making its report at an early day: indeed, it is generally thought that not much more will be done in the way of examination of witnesses.

The signal service, which has received much attention during the past year at the hands of this committee, as well as from the general public, i preparing for the introduction of one or two in

portant changes in its observation work about the first of January. The most notable is the introduction at the most important stations, and as rapidly as possible throughout the whole service, of the whirling psychrometer instead of the still wet and dry bulb now in use. An entirely new set of hygrometric tables has been computed for the reduction of observations made by the new method, a suitable whirling-machine has been devised and adopted, and machines for station use are now being constructed. It is also understood that the service has determined to use for this instrument thermometers with cylindrical bulbs, instead of the spherical bulbs at present used, on account of the greater sensitiveness of the former. The introduction of these improvements constitutes a decided advance in the hygrometric methods of the service. Z.

Washington, D.C., Dec. 14.

LONDON LETTER.

AT the election of the council and officers of the Royal society, which took place on St. Andrew's day, Prof. G. G. Stokes, the senior secretary of the society, was unanimously chosen as Professor Huxley's successor. He graduated at Cambridge in 1841 as senior wrangler and first Smith's prizeman, and was elected to his present office, the Lucasian professorship of mathematics, eight years afterwards. He was elected into the Royal society in 1851, and became its secretary in 1854. Professor Stokes's successor as secretary to the Royal society is Lord Rayleigh.

The award of one of the royal medals to Prof. E. Ray Lankester by the council of the Royal society will meet with the warm approval of all English biologists, and is a fitting recognition of his many contributions to zoölogical science, which range over a great variety of subjects, the earliest of them being now some twenty years old. Professor Lankester was for some years the only representative at Oxford of the modern school of zoölogy, and since his appointment to the zoölogical chair at University college he has trained several students of the greatest promise. He is also well known as the editor of the *Quarterly journal of microscopical science*, which, owing in great measure to his influence, has risen from being an organ of almost pure microscopy to the position of a first-class zoölogical journal. It is a good sign of the activity of the young biologists who are now being turned out from the universities of Oxford and Cambridge, London and Manchester, that the supply of contributions during this year has been more than sufficient for the regular quarterly issue of the journal. A supplemental number was published in July, and the first part of a new volume has just appeared, bringing up the total issue for the whole year to six parts instead of four, as has hitherto been the rule. The journal will in future appear at irregular intervals, just as the German zoölogical serials do, according to the amount of material in the editor's hands.

The 30th of November (St. Andrew's day), which closed Professor Huxley's term of office as president of the Royal society, has witnessed the retirement of Sir Joseph Dalton Hooker, a former occupant of the presidential chair, from the directorship of the Royal gardens, Kew. He was appointed assistant director in 1855, and succeeded to his present office ten years later, on the death of his father, the late Sir William Hooker. His administrative work has been well described as "performed in such wise as to win, along with national applause, the gratitude of the scientific world." It may almost be considered as certain that the vacancy will be filled by the promotion of his son-in-law, Prof. W. T. Thisleton Dyer, who is the present assistant director, and has been largely instrumental in bringing about the revolution in botanical teaching which has taken place in this country of late years.

As in the case of Professor Huxley, Sir Joseph Hooker's retirement from the routine of official duties will enable him to devote more time to purely scientific work than he has hitherto been able to give; and he will therefore be able to hasten the completion of his great monograph on the flora of British India.

At a recent lecture on the electric telegraph, delivered to the members of the Birkbeck institute, in London, by William Lant Carpenter, the following figures were given on the authority of the British general post-office, to indicate the increase of the use of the telegraph since the adoption of the 'twelve words for sixpence' (address included) rate: The total present mileage is 156,000 miles, and the number of instruments employed is 17,100, of which 26,000 miles and 900 instruments are due to the increase. In the week ending Nov. 14, 1885, 895,781 messages were sent, showing an increase of 40.3 per cent over the corresponding week of 1884. In London, however, the increase is 60 per cent; and in that city alone the 'registered addresses' have increased from 2,000 to 9,000. The average price of messages is 8d., as compared with 13d. under the old tariff. When the lines were purchased by the government in 1870, the average number of messages weekly was only 126,000, and the press messages, then barely 5,000 words per day, now exceed 1,000,000.

The electric lighting industry in England has been, as is generally known, almost throttled in its

infancy by legislative restrictions. Under the rules of the electric lighting act of 1882, no commercial company could light a district successfully, in a financial sense. In the new parliament, this, among other matters, calls for urgent notice and remedy. Meantime the Anglo-American Brush corporation is endeavoring to induce small groups of house-holders, four, six, or more, to unite in a joint local installation, at an initial cost of about $500 for an average-sized house. The plant proposed for such a group is either a steam or gas engine, dynamo, and secondary batteries, whose great use in domestic lighting has been repeatedly demonstrated by Mr. Preece, Mr. Swan, and many others interested in the matter.

At the recent opening of the session of the Society of arts, the president, Sir Frederick Abel, F.R.S., directed attention to machinery and appliances used in mines, and, contrary to general expectation, showed that explosions were not the greatest cause of loss of life in coal-mines. In the ten years 1875–1884, out of 11,165 deaths from accidents of all kinds in coal-mines, only 2,562, or roughly one-fourth, were due to fire-damp explosions; the remainder being caused in about equal shares by, 1°, falling in of roof and sides, and, 2°, other causes. The address, which is replete with interest, and can be read in full in the journal of the society for Nov. 20, concludes with some strong comments upon the part taken by the *Times* in regard to the delay in the report of the royal commission (of which the speaker was a member) upon the whole subject.

Two other presidential addresses lately delivered need a word of notice. The Marquis of Lorne (late governor-general of Canada), the president of the Royal geographical society, referred in some detail to the discoveries made in the basin of the river Kongo, in Africa, by Rev. G. Grenfell (a Baptist missionary) and Lieutenant Wissmann, as well as by Portuguese travellers. He then called attention to the recent endeavors of the society to improve geographical education in English schools and colleges, and to the exhibition, shortly to be held, of appliances and methods of teaching it, collected by the society's special commissioner, Mr. J. S. Keltie, in a recent continental tour.

During November a meeting was held in London to celebrate the granting of a royal charter to the Institute of chemistry, a body which has been at work for some years, with the avowed object of raising the status of analytical chemists, and doing for them what the College of surgeons, the old guilds, and the modern trades-unions, do for their respective professions and trades. An address was delivered on the occasion by Professor Odling, the president, who holds the chemical chair in the University of Oxford. He beg with a history of the movement, and the incre ing need of 'professional services,' and then c sidered the position of 'experts' as witnesses in law-courts. The part of his address, howev most criticised, is that in which he dealt with vexed question of the endowment of resea and the pursuit of research, on the one hand, its own sake alone; on the other, for the pecuni rewards which are sometimes the result of *Nature* concludes a long article upon it in words, "We wish it to be known, therefore, t the spirit it (Professor Odling's address) breat is an alien spirit, repugnant to students of p science in this country." W.

London, Dec. 1.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. writer's name is in all cases required as proof of good faith.*

Newcomb's 'Political economy.'

Mr. James has quite misunderstood my rem about bimetallism. I admitted that the word *ass* did not correctly convey Professor Newcomb's id and I thought I sufficiently indicated that Profes Newcomb's sole intention, in the passage in questi evidently was to tell the student what was *meant* a system of unlimited bimetallism. In other wor his sentence (which I admitted was unfortunat worded) was simply meant to state that the gove ment *chose* a fixed ratio of values in their system coinage. Newcomb says nothing at this point in way of discussion; in a later part of the work he votes a considerable amount of space to an exami tion of the arguments on both sides, and does not fi that we can positively declare either that the bimet lists are wrong, or that they are right. Under th circumstances, I leave it to the reader to dec whether Professor James has dealt fairly with author in insinuating that he caricatured the vie of bimetallists.

As to the rest of Professor James's reply, I sh permit myself only one remark. He, in comm with many of his school, seems to identify Engl political economy with *laissez-faire*, and persisten confuses the question of scientific method with th of practical conclusions. This is illustrated by wh he says about Sidgwick. He does not deny — wh is obvious to every reader, and what Sidgwick e pressly asserts — that Sidgwick's method is essentia that of the earlier English economists; and this w the only relevant question. Of course, Sidgwic book shows marks of his indebtedness to Germ writers, when he explicitly acknowledges (as I m tioned) his special obligations to Held and Wagne but this does not in the least modify the fact that method of investigation (or 'style of reasoning,' quote Professor James) is quite unaffected by th writers; and this was the only point at issue. I with a writer who sees no distinction between an herence to the methods of Mill (which was wha spoke of) and an adherence to his 'methods and s tem' (whatever that may be), it is hardly profita to carry on a controversy. Fabian Franklin

Baltimore, Dec. 11.

A national university.

trictures in *Science* (vi. 509) upon the recom-
on of Secretary Lamar that a national uni-
be established in Washington, seem to me to
l upon a narrow view of the subject, and to
y answered. The fact that the project has
posed by the able president of one of the lead-
owed colleges, who would be least disposed
with favor upon any rival institution, cannot
urged as an argument against it, and that
committee should have been found indifferent
872 has no bearing on its merits.
laim that there is "a fatal defect in any con-
al bill to establish a university, so long as the
s of appointment to United States offices, and
ire of those offices, remain what they now
nnot be sustained in the face of the excellent
manent scientific bureaus that have latterly
p under the government, and to which the
y refers. The officers of these bureaus have
ected with special reference to their fitness,
oved by the results; and they have almost,
exception, held office continuously through
dministrations, including the recent reversal
s. No such narrow policy as that of terri-
epresentation has governed these appoint-
he government having exercised its right
from the entire country, and secure the best

ermanent tenure of office is by no means
in private institutions. Even the highest
changes without detriment. Examples here
superfluous. The government should surely
same right that these have to improve the
f its staff of officers. This objection, there-
ms purely imaginary.
erritorial distribution of scholarships, on the
nd, ought to have nothing objectionable about
trikes me as altogether proper. The few
that can at best be instructed in any one
n, however large, are but a small fraction
umber who desire and will receive advanced
ou in the whole country; and it seems right
se few should, as nearly as practicable,
t the whole country territorially. Neither
re seem any inherent evil in permitting the
representatives to control this trifling pat-

true university is not a mere school for the
of great numbers of young people. It is an
n in which the most perfect appliances for
research may be brought together, and where
o are able and willing to avail themselves of
y have an opportunity to do so. The tenor
ecretary's report clearly shows that this is
contemplated by a national university. He
the existing scientific bureaus of the gov-
with all their apparatus and appliances, as
dation' upon which to erect a university as
tructure,' thus making it a positive aid to
ssary research that the government must
. The whole would thus become a great
institute, analogous in some respects to the
of France.
, the assumption that the establishment of
nstitution would 'be acting on un-American
,' is, I think, also untenable. It would seem
utset that a project that found favor in
of 'Washington, Adams, Jefferson, and
could scarcely be regarded as 'un-American.' Is it, then, implied that schemes of public instruction are generally un-American? Certainly no other country in the world possesses any such system of public schools as the United States, and perhaps no American institution is more popular than our educational system. Whether sound or unsound, popular or state education is at least a thoroughly American idea, and the tendency is constantly to extend it to the higher branches of learning; as, witness the 'grammar schools' of most cities, and the numerous state universities. It is true that this work is chiefly conducted by states and municipalities, as the natural way under a government constituted as ours is; but for a long time there has also existed a national 'bureau of education' at the seat of government, designed to aid and advise, rather than to control the entire system.

Neither can it be considered un-American for the government to encourage and actively prosecute scientific researches. No government in the world is doing so much in this line to-day as the United States, and *Science* stands in an excellent position to know the extent and quality of our government scientific work as well as the practical results which it is producing. In this respect we are becoming the envy of European nations, and they are just now beginning to learn from us that it is sound national policy.

A national university or institute of the kind intimated in Secretary Lamar's report would be thoroughly American in its conception and aims, and would fittingly crown the educational system of the country. Its organization should, and probably would, be largely intrusted to the National academy of sciences, whose advice in scientific matters the government is legally entitled to ask. On the contrary, the objections raised in *Science* seem to reflect the views of a now waning English school of economists, who continually cry 'let alone' to every thing the government undertakes. LESTER F. WARD.

[When a young man enters the service of any of our half-dozen leading colleges, he does so with the knowledge, that, as soon as he has proved himself a valuable member of the body of teachers, he will be given a position with a tenure of office through good behavior, and with a fair salary considering this permanency. In any university established by congress, not only would permanence of tenure be out of the question, but the efficiency will be affected and the very life of the institution threatened each year by the vacillating policy which any legislative body will necessarily pursue with regard to the sustaining appropriations. Whenever this country is ready for an American 'institute,' it will probably be an outgrowth of the National academy, the value of which is as yet not appreciated. Let us go slowly. It must be remembered that the principal advocates of the importance of governmental guidance of human affairs are residents of a country in which no other initiative force has been known. — ED.]

Crystals in maple sirup.

I was surprised on reading in your issue of Dec. 11 the note from Mr. J. H. Sears, in which he speaks of crystals formed in maple sirup being noticed for the first time. I had supposed it to be a very common occurrence. So far as my observation has gone,

unless the sirup be put into the cans in a very watery condition, the formation of a thick layer of crystals at the bottom invariably follows; and I have often seen great difficulty experienced in removing it without breaking the cans. J. EDWARD CHAPPEL.

Warsaw, N.Y., Dec. 14.

International geological congress at Berlin.

On referring to the original notes which I took during the sessions of the International geological congress, I find that Mr. Archibald Geikie moved to strike out all the words after 'Coudroz' except 'l'Old Red,' in the paragraph (l. c., p. 15) of the report of the committee on uniformity of nomenclature, my account of which Dr. Dewalque criticises in *Science*, Dec. 11. Upon this, M. Renevier asked, 'on principle,' that the whole paragraph be struck out, on the ground that the congress ought not to go into such details. There is no mention in my rough notes that this was done; but in the fair copy, which I submitted to some of the leading members of the congress for their approval or correction, I find a pencil note to the effect that M. Renevier's motion was carried. I cannot recall the authority for this note, which was embodied in the short summary which, with the assistance of Professor Williams, I prepared for *Science*. I should like to state here, that in spite of the employment of the greatest possible care, and the assurances of the accuracy of the account of the meeting, which is about to appear in the *American journal of science and arts*, from some of the most active participants in the discussions, some errors, though I trust none of importance, will probably be found. To those who are aware of the exceedingly inferior acoustic qualities of the hall, and the involved nature of some of the discussions and votes, these will be thought pardonable. PERSIFOR FRAZER.

Philadelphia, Dec. 12.

Earthquake-shocks more violent on the surface than in mines.

It has been sometimes observed that earthquake-shocks are felt more severely in mines than at the surface. This may be accounted for partly by the rapid decrease of the shock-motion (wave-height) which is supposed to vary inversely as the square of the distance from the focus or radius of the agitated sphere, partly by the quenching of the earth-wave by repeated reflections in passing through media of different elasticities, and by the fracturing of the imperfectly coherent media through which it passes. But the converse phenomenon, viz., the greater severity of shocks on the surface than in mines, is, I believe, far more common. This was very conspicuous in the Inyo earthquake of 1872; for buildings were shattered and the earth was broken in many places, and yet persons working in the mines were scarcely aware of any movement. The same has often been observed in Peru.

There are two ways in which I imagine this may be explained. The more obvious is as follows: As long as the earth-wave is within the earth, the back-and-forth movement (shock-movement) is largely restrained by the work of elastic compression of the earth in front necessary for the progress of the wave. But as soon as it reaches the surface the motion is free or unresisted, and therefore much more rapid, — so rapid as often to break up the surface, and throw loose lying bodies high into the air. But th another explanation which is perhaps more dou and which, therefore, I offer with some hesitat a mere suggestion, in the hope that some one m able either to follow it up or else to disprove it.

In the *Philosophical magazine* of June, 18 404, the royal astronomer, Professor Airy, dr tention to the peculiar phenomena of what h broken waves, or broken-headed waves. The retarded, discontinuous waves; in other words, l ers. If a normal wave strike against a sea it will of course be reflected; but if a breal broken or broken-headed wave, thus strik swell or unbroken part is reflected as usual, b broken part is not. If it strike perpendicularl broken part is thrown up and destroyed. strike at small angle, then the broken part runs as a strong wave clinging to the surface of the I have myself observed this behavior of b waves.

Professor Airy then applies this principle t explanation of certain phenomena of whisp galleries. The voice produces normal waves; hiss, a buzz, and therefore a whisper, pr broken, discontinuous waves. Now, in these leries the voice is reflected in the ordinary way a whisper runs along, clinging to the surface o wall and dome, and may be heard, if the e applied to the wall, at much greater distance the much louder voice.

Now, may not this principle be applied al earthquake-waves? 1°. The surface of the must be regarded as a very perfect reflectio waves emerging from below; as much so, in fa for sound-waves entering the earth from th Therefore normal waves emerging on the su must be largely reflected back into the earth a 2°. But earthquakes are pre-eminently broke tarded, discontinuous waves. Passing, as the through an imperfectly elastic and slightly coh medium, which is fissured and crushed at every of its progress, the normal continuity of the wa destroyed, and the waves retarded and their e dissipated, by change into other forms of especially heat. For this reason the velocit heavy earthquake-waves is always much less that of normal elastic waves in the same me For this reason, too, they are rapidly quenched therefore extend much less distance than they wise would. 3°. If, then, we assume that earthq waves are broken and retarded waves, they ou follow the law pointed out by Professor Airy. they strike full on the surface, as at the e trum, they simply destroy themselves by the w breaking the surface, and are not reflected. they strike at small angle, as at a distance epicentrum, they must run along as a strong clinging to the surface. JOSEPH LE CO

Berkeley, Cal., Dec. 5.

An unreliable treatise on disinfectant

That 'unreliable treatise on disinfectants' cised by you Dec. 4, deserves even less merc you have shown it. When the publisher de that there is no indorsement of the essays as tific, and the one selected as the best is cho a standard of the excellence of the work as a all persons in the least familiar with the p position of sanitary science must wonder wh

volume ever saw the light. Mr. Benjamin's article was singled out by Messrs. Lattimore and Remington as worthy of the first prize, probably because of the following 'practical and otherwise valuable' information which it contains: "All that is required to immediately purify and sweeten a contaminated air-supply, however originated, is to dip a cloth in the liquid (a solution of nitrate of lead and common salt), and hang it up in the apartment." Or perhaps they thought sulphate of iron, charcoal, and table salt were of much greater value than chlorinated lime, mercuric chloride, or mercuric iodide. Their fathers thought so, and therefore the new-fangled notions of bacteriologists must be disregarded as unscientific and impractical. They believed that Dr. Baker's special training as a physician, and his experience as founder of the state board of health of Michigan, as well as member of the committee on disinfectants of the National board of health, unfitted him as a judge of such matters. In spite of his earnest protests, they insisted upon giving the first prize to a paper which he declared was unworthy any prize. Their special training as analytical and pharmaceutical chemists fitted them for just such work, because they knew nothing of Pasteur or Magnin, Koch or Miguel, Sternberg or Klein, other than they happened to see in the *Rochester post* or *Philadelphia ledger*.

G.

Brooklyn, Dec. 11.

The English sparrow.

The despised sparrow is entitled to a good word if he can secure it. He has come to stay, and no amount of vituperation will displace him. 'He is too many,' and has spread over too large a portion of the union. The sparrows crossed the Mississippi River at Clinton, Io., about 1875, and have increased largely. They confine themselves principally to the railroad buildings and some of the business blocks, though they occasionally nest on private houses.

When this town was founded, twenty-five years ago, there were no trees or shrubbery near, and consequently few birds. Now the town looks like a forest in the distance. The consequence is that robins, thrushes, orioles, blackbirds, bluebirds, and many other birds, are very numerous, and seem to be increasing. Numbers of blue jays nest in the shade-trees, and stay with us during winter. The sparrows have never seemed to drive any away, as each year more nests of summer birds have been observed. They confine themselves to the open spaces and streets, and do not nest or frequent the trees or shrubbery. They have never been observed in the fields outside of town, and do no injury to fruit or seeds in gardens. They live largely on insects, as has been shown by examining their crops. In winter they are mainly dependent on the seeds and grains they can pick up. They fall victims to the jays and the butcher birds, but a crowd of them makes a good fight against the aggressors. There are millions of them in every large town, on the railroads of this state, and there is no way of exterminating them, and no wish to on the part of unprejudiced people. There is no law for their protection in this state, only a general friendliness toward them as toward all small birds.

P. J. FARNSWORTH.

Clinton, Io., Dec. 10.

It must be admitted that the English house-sparrow will eat seeds and fruit, but it should be remembered that the young sparrows are fed chiefly on insects and caterpillars; and a good English authority (Yarrell) observes that "so great is the number of these consumed by the parent birds and their successive broods of young, that it is a question whether the benefit thus performed is not an equivalent even for the grain and seeds eaten by the adult birds at other seasons of the year."

Dr. Elliott Coues, in his notes to Stearns' 'New England birds,' advocates the extermination of the English sparrow, and calls it 'the parasite.' This is not a translation of its scientific name, Passer domesticus, and does not accord with any known habit of the birds in question. Dr. Coues has no fault to find with a native tree-sparrow (Spizella monticola), which he says exists in large quantities, and feeds only on grain and seeds. All specimens shot by Dr. Coues had their crops full of seeds.

The sparrows which damage the crops and orchards in England are another species, called the field-sparrow. I have seen these in flocks of over a thousand rise at one time from a field of grain. This is, I presume, the bird described by Dr. Coues as Passer montanus. He states they are now found in New England, but I never heard of their having been imported.

I rather doubt the stories about the English sparrows molesting the bluebirds at breeding time. It is well known that most birds are very pugnacious at this period, and I am personally acquainted with the fact that bluebirds are particularly courageous at this season. On one occasion a bluebird made its nest in my garden, in the hollow of a tree, about six feet from the ground. One day, when busy inspecting the nest, I received a violent blow on the side of the head, and, on looking up, saw the parent bluebird flying away. I found that whenever I placed my hand in the nest, I was attacked in this manner. I apprehend, that, if a bluebird will attack a man in defence of its nest, it is not likely that a sparrow would do so with impunity.

I notice that Dr. Bechstein, in his standard work on birds, published as one of Bohn's library, states, that although the house-sparrow has no song, he can be educated to sing equal to the canary. I was also surprised to find in the same work (p. 249) that the house-sparrow could be taught to speak: it mentions a clergyman of Paris who had two of these birds which could repeat the fourth, fifth, sixth, and seventh commandments. It is gravely stated that when these birds quarrelled over their food, "one of them would admonish the other with the remark, 'Tu ne voleras pas.'"

Giving due credit to the house-sparrow for all his accomplishments, I fear he can speak the French language only in fable.

JOHN MICHELS.

New York, Dec. 10.

The temperature of the moon.

Now that the temperature of the moon has become a subject of investigation with the aid of recent refinements in the methods of observing very small intensities of heat radiation, it may be well to also look at the matter from another stand point.

The condition which determines the static mean temperature of the whole mass of the moon is, that its rate of losing heat by radiation from its surface shall be exactly equal to the rate with which it receives and absorbs the heat radiated from the sun,

in comparison with which the heat coming from the stars, and that radiated and reflected by the earth, may be neglected without any sensible error. But by the generally recognized principle that the relative radiating and absorbing powers of bodies are equal, the ratio between radiation and absorption is the same for all bodies at a given temperature; so that it is not necessary to consider the radiating power of the moon, but to simply satisfy the condition that the moon, with a surface of maximum radiating power, such as a lampblack surface, shall radiate heat as fast as it is received from the sun.

All bodies are so constituted that their absolute radiating power is a function of the temperature, the former increasing with the latter, but by no means in proportion. If, therefore, we know the relation between the temperature of a body and its rate of radiating heat, and also know the rate with which it is receiving heat from its surroundings, we can, by means of the preceding condition, form an equation of condition which determines the temperature.

According to Pouillet's determination from the experiments of Dulong and Petit, a square centimetre of surface of maximum radiating power, and at the temperature of 0° C., radiates 1.146 calories of heat per minute; and hence, by the law of Dulong and Petit, the rate of radiating heat for any other temperature θ, is $1.146_\mu{}^\theta$, in which $\mu = 1.0077$. The rate with which a square centimetre of surface normal to the direction of the sun's rays receives heat from the sun is what is called *the solar constant*, usually denoted by A. Putting, therefore, s for the area of the moon's surface in square centimetres, and a for that of a great circle, the rate with which heat is radiated from the moon's surface is expressed by $1.146\,{}_\mu{}^\theta s$, and the rate with which it is received from the sun, by Aa. Hence, by the conditions above, since $s = 4a$, we get in the case of the moon in space, in which it loses heat by radiation only, and receives it from the sun only, the equation

$$_\mu{}^\theta = \frac{A}{4.584}$$

for determining θ where A is known. Since $\log \mu$ is exactly equal to 1-300, this may be put into the following convenient and practical form:—

$$\theta = 300 \log \frac{A}{4.584} = 300\,(\log A - 0.6612).$$

From this equation, deduced as a simple case from a more general and mathematical treatment of the subject in the 'Temperature of the atmosphere and earth's surface,'[1] the writer, with the assumed value of $A = 2.2$, deduced the value of $\theta = -96°$ C. But as there is some uncertainty with regard to the value of this constant, since some of the solar rays may be entirely absorbed before reaching the earth's surface, and it is thought by some to be considerably greater than this, we shall put it here equal to 2.5. With this value we get $\theta = -79°$. This must be understood to be the mean surface temperature of the moon, or, more accurately, the temperature of a surface uniformly heated which would radiate as much heat as the surface of the moon, which, of course, has very different temperatures on opposite sides at any given time.

The law of Dulong and Petit being an empirical one, which satisfied the experiments from 0° to 300° only, there is some uncertainty in extending it down to −79°; but this is very small in comparison with what it is in extending it in the other direction, up temperature of the sun, as has been done by P and others, in forming an equation for deter its temperature. The uncertainty in the true of A, together with that in the extension of t down to so low a temperature, causes some tainty in the mean temperature of the moon determined; but this is not very great in a ma this sort, for it amounts to only 17° in an uncer of one-eighth part in the value of A.

But when we attempt to determine the te ture of the side of the full moon exposed to t and earth, the uncertainty becomes very greater. In this case the heat is not only r from the surface, but it is also conducted i from the surface heated far above the mean te ture of the moon, and stored away for the tim rate with which it is conducted in depends up conductivity and capacity of the lunar soil fo which are unknown to us; and the problem w extremely complex if they were known. Th perature of the moon's surface, in this case, c be determined for the two extreme hypotheses finitely great and infinitely small conductivit heat. Upon the first hypothesis, the heat r and absorbed by the moon would be instant tributed through the whole mass, and r equally by all parts of the moon's surface, a temperature of the part exposed to the sun would be the mean temperature of the moon tained above. Upon the other hypothesis, it not be conducted away at all from the surface ing it, but, in case of a static temperature, it all have to be radiated away by the same surf ceiving it. Hence, in this case, instead of th ating surface being four times as great as the s or normal sectional area receiving it, it is only to it for the part of the moon's surface upon the sun's rays fall perpendicularly, and we therefore have $1.146_\mu{}^\theta = A$, or

$$\theta = 300 \log \frac{A}{1.146} = 300\,(\log A - 0.0592),$$

instead of the preceding similar expression.

With the assumed value of $A = 2.5$, this $\theta = 101°$ for the temperature of the central p the moon's disk as viewed from the sun, and the earth at full moon. For other parts, the of A in the preceding expression must be mul into the cosine of the angle of incidence of th rays upon the moon's surface, and thus this e sion will give the temperature down as low a safe to extend Dulong and Petit's law. The sa sults would be obtained sensibly with any on conductivity for heat if the same side of the were permanently exposed to the sun, for th perature gradient by which the heat would b ducted inward would soon become so small, case, that the rate by which heat would be con inward would be insensible, as in the case in heat is conducted outward from the interior earth.

The result above, of 101°, which is a little the temperature of boiling water, must be re simply as a limit beyond which, in a large ra uncertainty, the temperature cannot go. The limit is −79°. If we suppose the temperature warmest part of the moon's disk to fall halfw tween these extremes, it would be a very little a freezing temperature. William Fer

[1] Professional papers of the signal service, No. xiii.

SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 18, 1885.

THE MIND-CURE.

THE attraction of the mysterious is proverbial; and, as no satisfactory explanation has yet been offered for the series of phenomena which are included in the term 'mind-cure,' it is not surprising that the general interest in it keeps alive. The facts are both too old and too new to be ignored. From the time when Moses lifted up the brazen serpent in the wilderness, and assured those who had been bitten by the desert scorpions that if they looked fixedly at it they would recover, down to the present day, when the faithful Catholics visit Lourdes in crowds, religious, psychological, and medical records have contained 'authentic' accounts of mind-cures. The facts have been heralded under different names, — 'miracles,' 'mesmerism,' 'animal magnetism,' 'spiritualism,' 'expectant attention,' the 'faith-cure.' They have always aroused attention, they have given rise to many theories and endless disputes, and they have baffled explanation. The last attempt to solve the problem[1] is no more satisfactory than others. What are the phenomena with which it tries to deal?

If you fix your mind upon one of your fingers, and look at it steadily for five minutes, you will become conscious of sensations in that finger which were previously unnoticed. If the finger happens to be cut, the pain will become more acute, and it may begin to bleed. If it does bleed, and you feel alarmed, you will breathe more rapidly, your heart may palpitate, and your face will turn pale: you may even faint away. This is a simple series of phenomena which illustrate the interactions of mind and body. If you happen to have overeaten, and in consequence begin to suffer from indigestion, you will notice not only a physical discomfort in the stomach, but also an indisposition to mental effort, an undue weariness on slight emotion, a growing inclination to look upon the dark side of things, and, if the dyspepsia becomes chronic, a decided persuasion that your financial affairs are becoming involved. Niemeyer relates a story of a very wealthy man whom he treated for chronic catarrh of the stomach. During the disease he thought he was near bankruptcy, and left unfinished a building that he had begun, because he thought he had not sufficient money to continue it. After spending four weeks at Carlsbad, his old strength and feelings returned, and he finished his house with great splendor. Probably there is no one who cannot recollect some instance equally striking of an influence of bodily condition upon mental action.

The facts of central localization of late established, have been thought to bear somewhat upon this subject. Every portion of the body sends in a set of nerve-threads to a corresponding portion of the brain, so that an imaginary map of the organs and surface can be pictured upon the surface of the cerebral hemispheres. The changes in any organ are therefore communicated to the part of the brain which presides over the organ; and, conversely, changes in that part of the brain may be communicated in turn to the organ. If we accept the theory that when the attention is directed to an organ its part of the brain is thrown into activity and becomes highly receptive and highly potential, we have simply advanced from one set of facts to another without at all touching the problem of how the interaction is brought about.

There are certain affections, however, which can be explained satisfactorily only on the theory that the disease lies, not in the organ which is supposed to be affected, but in the part of the brain which corresponds to it. If my finger is receiving impressions of heat or cold which pass unnoticed until I think of the finger, it is conceivable that my attention might be held so closely to some startling sight, that even a severe and painful impression in the finger might be unheeded in my interest in the terrible spectacle. Soldiers in battle have been known to go on fighting, though wounded, without perceiving their wound. Here a true mental loss of sensation has been present. Conversely, I may be in such a state of expectation regarding an organ, that a slight sensation in that organ may be misinterpreted and exaggerated till it corresponds with the expected feeling. At night, in the dark, how our youthful fears have been excited by a slight noise in the room! The story goes, that a French convicted criminal was told that he was to be bled to death; and when his eyes had been bandaged, and his arm touched with a cold iron, drops of water were allowed to fall into a basin at his side, where he could hear them. He gradually became more and more pallid, and at

[1] *Mind-cure on a material basis.* By SARAH E. TITCOMB. Boston, *Cupples, Upham, & Co.*, 1885. 8°.

LAYING A CABLE.

IT was not much of a cable, after all, and its laying was no great performance, although forty years ago it might have been considered a marvel.

Science, in its so-called practical aspects, is now advancing in parallel lines; and these are so numerous, and some of them so far-reaching, that most men are unable to follow along more than one or two. This fact has suggested the idea that there may be something of interest to many in a description of this cable, and of the operation of putting it in the water.

It does not connect us with any foreign country; it does not complete the girdle round the earth: it is modestly content to serve as the link which joins the intelligence of the rest of the world with that of the interesting and important islands, Martha's Vineyard and Nantucket, where formerly the influence of the whale prevailed over all else, but now, alas! tributary to the state of Massachusetts, from which comes good government, and to the Standard oil company, from which comes petroleum, that arch enemy of the whale trade. But exclusiveness, even when aided by insulation, must give way to the progress of events. A glance at the map will show the nature of the forces operating in this case. Vineyard Sound is the great highway of the coasting trade. Thousands of vessels of all kinds pass through it every year. The harbors of Vineyard Haven (correctly named), Tarpaulin Cove, Lambert's Cove, etc., afford shelter for hundreds during rough weather. Wrecks are, unfortunately, not infrequent; and a visitor from the outside world is likely to see in the simple but perfectly neat and thrifty-looking home of the fisherman-farmer a carved and upholstered chair, or something of the kind, which is referred to with no little pride as a relic from the wreck of some passenger-steamer which went ashore with the loss of many lives and much property upon the coast near by.

The principal and sufficient reason for asking for a special appropriation from congress to secure telegraph communication with the mainland, was that stations of the U.S. signal service might be established on the islands, and particularly that danger-signals might then be displayed from the more prominent points for the guidance of the numerous sailing-craft constantly passing through the sound. Some years of effort were rewarded with success at the last session, an appropriation of forty thousand dollars having been made for the purpose of laying the necessary cable, amounting in all to less than thirty miles, and for erecting the land-lines, display-stations, etc. The work has been done, therefore, under the direction of the chief signal-officer.

The cable was made in London, and shipped to New York in the hold of a steamer, coiled in two large tanks especially built in the steamer for that purpose. It fortunately happens that the gutta-percha insulation, used almost exclusively for submarine cables, is improved and preserved by being kept damp, cracking and deteriorating when dry. For this reason it is necessary to keep the cable in tanks during its passage, so that it may be kept covered with water. The conducting part of the cable consists of seven copper wires, each about .028 inch in diameter, six being twisted about the seventh as a centre. The resistance of this conductor was not to exceed thirteen ohms per nautical mile, and it fell considerably short of that upon being measured. This copper core was covered with three or four layers of gutta-percha, until the diameter of what might be called the cable proper was a little more than a quarter of an inch. Such a cable would scarcely last while it was being put down, and it is therefore necessary to put an 'armor' upon it, so that it may be able to endure the destructive agencies to which it is likely to be subjected. The gutta-percha-copper core is wound with two or three layers of heavy jute twine, and this, again, with twelve number five galvanized iron wires laid on spirally. The result is apparently a strong iron rope about an inch and a quarter in diameter.

An examination of the cable was made in New York City, before its removal from the tanks referred to, for the purpose of seeing that its insulation was still intact. It was then transferred to a barge lying alongside, from which it was to be laid, and in which it was towed through the sound to Vineyard Haven. Its arrival at this place caused little less than a sensation. The first section of the cable was to be placed across Vineyard Sound; and, although not the longest, it was the section likely to cause the greatest anxiety. In fact, the Western union telegraph company has several times tried to place and maintain a cable from West Chop light on Martha's Vineyard to Nobska Point on the mainland, but their efforts have not been altogether successful. The damage to a cable across the sound arises from two sources. The tidal current is strong, at some points nearly three miles per hour; the seaweed, which is carried back and forth by this current, is caught on any suspended or exposed part of the cable, and twisted around it until huge, solid masses are attached to it, which offer so much surface to the swift current that the cable must give way under the strain. The other source of danger is quite as disastrous, and nearly as uncontrollable. It

is in the dragging of ships' anchors across the line of the cable. In this way the cable is caught in the anchor and brought to the surface when the latter is hoisted. A little intelligence combined with good nature would enable the shipmaster to release the cable and drop it uninjured; but more frequently, in his annoyance, he will deliberately cut it in order to escape, although release without injury could be accomplished in less time. In putting in this cable, it was desirable to locate it so that the chances of damage from both of these sources might be reduced to a minimum. To this end the officers in charge of its laying did not need to seek advice from persons familiar with the waters, for it was freely offered by every inhabitant of the islands. The multitude included a few old sea-captains, who seemed to know every foot of the coast, and to understand the nature of the bottom of the sea; and it is believed that their words were words of wisdom. The route selected lay across the sound several miles to the westward of that already referred to. If is undoubtedly freer from probable damage arising out of the anchorage of vessels, but time alone can determine to what extent.

Every thing being in readiness, the barge was towed to the starting-point, which was the northern terminus of the cable on Naushon Island. As there was a good deal of a 'sea' running, it was not possible to approach nearer than twelve hundred or fifteen hundred feet from the shore. The tug was anchored, and the barge was allowed to drift in a few hundred feet farther. A stout rope an inch and a half in diameter was then attached to the end of the cable, eight or ten men were put into a boat, and the other end of the rope was carried ashore. The end of the cable was dropped overboard, and the operation of pulling it to the beach began. This was finally successful, and the shore end was made fast to a stout post which had been erected for the purpose. All hands came on board, anchor was weighed, the barge made fast to the tug, and the journey across the sound was begun. The cable lay in two great coils in the barge, and dropped into the water over the stern. It passed around and over a couple of large reels or drums, where a large pulley-brake was applied to it in order to regulate the tension to which it was subjected. To one of the drums a counter was attached, so that the rate at which it was paying out could at any time be determined. Wind and tide opposed each other, and the rate of sailing did not exceed five or six miles per hour. The opposition of wind and tide was favorable to a straight course, and good pilotage secured a run across which undoubtedly put the cable down in almost exactly a straight line from the point of departure to the southe terminus on Martha's Vineyard. At this end t landing was a little more difficult. A rope w first carried ashore, its length measured as it we out, to determine where to cut the cable that might reach the beach from the anchorage. I its next trip the little surf-boat carried a sm weather-worn 'A' tent, a rough bench, batteri galvanometers, resistance coils, and two shiveri signal-service men, who were to test the cable soon as it was landed. A rude testing-station w soon established amid the hillocks of sand, and t instruments were in position when the cable w at last landed, and secured to a portion of t wreck of an unfortunate vessel that had strand upon the shore many years before. But the hi winds were still rising, darkness was coming c and the captain of the tug, declaring that he h had enough of cables for one day, ordered a hands on board forthwith. It was impossible leave the instruments in that condition, and t prospects for a night on the beach seemed goo when the hospitality of the owner of the o house within sight brought relief, furnishing storehouse for the appliances, a well-suppli table for keen appetites, and a wagon-ride at nig through the woods to the hotel, seven or eig miles away.

On the following day the termini were aga visited, the ends properly secured, and the cal tested. A trench was dug in the sand down low-water mark, in which the cable w buried. At a point above high tide on the bea a strong post was erected, to which the cable w secured by means of a heavy chain; from whi point, still underground, it was carried higher the sand-hills on which it had been landed, to t foot of an ordinary telegraph-pole. It extend up the side of this, being enclosed in a box un it reached the top, where it entered the cable-h proper, the end being secured to a binding-scr ready for connection later with the land-li Some of the party had been sent to Nausl Island, carrying with them an ordinary telegr instrument and key. By previous agreement was to be connected with the cable at once on arrival of the party. A few cells of battery an similar instrument were joined to the end Martha's Vineyard, and the two expeditions h been timed so accurately that almost instan responsive ticks proved that intelligence wa work on the other side. Much interest is ot felt in the first message transmitted throug cable or telegraph line. Brushing aside romance of the thing, it is safe to say that in cases out of ten the first message is that wh traversed the river first on this occasion, b

simply, 'Do you get me now?' After some further interchange of compliments, the operator on Naushon was directed to seal up the end of the cable by covering the exposed wire with gutta-percha. This having been done, communication ceased, and the insulation was tested. A number of battery cells were joined 'in series' to the galvanometer, which was a delicate instrument of high resistance, with a reflecting mirror, and to this the end of the cable was attached. The test was practically an endeavor to force the current through the gutta-percha insulation, the amount of the leak being measured by the deflection of the galvanometer needle. It had been demanded of the cable that it should show an insulation resistance of at least two hundred and fifty megohms per mile, and it greatly exceeded this number when tested.

A few days later, when wind and weather were favorable, the island of Nantucket was connected in a similar way with Martha's Vineyard, the cable taking a sweep out into the sea to avoid shoals; and finally a short piece, about a mile in length, was made to connect Naushon, by way of the little island Uncatena (always 'Uncle Timmy' at home), with Wood's Holl, and thus was completed the union of these islands with the mainland, which it is hoped may last for many years.

M.

PHYSICS AT JOHNS HOPKINS.

THE large and well-appointed laboratories recently erected by the trustees of the Johns Hopkins university for the chemical and biological departments have by contrast made the more evident the needs of the physical department, which has been obliged to occupy temporarily parts of four different buildings. The trustees, recognizing this need, are now erecting a building for a physical laboratory. The new laboratory is to be a handsome building of red brick, trimmed with brown sandstone, and will occupy a fine site about a block from the other university buildings, on the corner of a quiet little street midway between the more important streets, which carry the bulk of the traffic of that region. It will therefore be as free from disturbance from the earth vibrations as could be expected in a city.

The building will be 115 feet long by 70 feet broad, and will have four stories besides the basement. In the centre of the building, and below the basement, are several vaults for instruments requiring to be used at constant temperature, also a fire-proof vault for storage. In these vaults will be placed Professor Rowland's dividing-engine, by which the diffraction gratings are ruled, and the Rogers-Bond comparator, which has recently become the property of the university. In the basement will be rooms for the mechanical workshop, for furnaces, and for piers for instruments requiring great stability. The first floor will include the main lecture-room, which will accommodate 150 persons, and rooms for investigations by advanced students in heat and electricity. The second floor will contain mathematical lecture-rooms, studies for instructors, and a room for the mathematical and physical library of the university.

The elementary laboratory will be on the third floor, which will also have rooms for more advanced work. The fourth floor will contain rooms for special work in light.

There will be a tower on the south-east corner of the building, which will have two rooms above the fourth floor. The upper of these will be provided with telescope and dome, and will be a convenient observatory when great steadiness in the instruments is not required. There will be power in the building for driving the machinery in the workshop and for running the dynamo-machines. A large section of the building is to be made entirely free from iron. The sash-weights will be of lead, and the gas-pipes of brass. Brackets will be attached to the walls, on which galvanometers and cathetometers may be placed. In order to avoid the inconvenience of having piers go up through the lower rooms, and yet to secure steadiness, beams have been introduced into the floors, which reach from one wall to the other between the regular floor-beams, and do not touch the floor at any point. If, now, a table is made to rest on two of these beams, by making holes in the floor over them to admit the legs of the table, it is entirely undisturbed by any one walking over the floor, except by such motion as is transmitted to the walls. There will also be a small vertical shaft in the wall of the tower, running from top to bottom, in which a mercurial manometer may be set up.

The vaults for constant temperature have been built with double walls, so that a current of air may be drawn between them whenever desirable to prevent dampness. It is expected that the laboratory will be ready by October next.

The photographic map of the spectrum, upon which Professor Rowland has expended so much hard work during the past three years, is nearly ready for publication. The map is issued in a series of seven plates, covering the region from wave-length 3100 to 5790. Each plate is three feet long and one foot wide, and contains two strips of the spectrum, except plate No. 2, which contains three. Most of the plates are on a scale three

times that of Angström's map, and in definition are more than equal to any map yet published, at least to wave-length 5325. The 1474 line is widely double, as also are b_3 and b_4, while E may be recognized as double by the expert. In the region of the H line these photographs show even more than Lockyer's map of that region. Negatives have also been prepared down to and including the B group, and they may be made ready for publication, one of which shows eleven lines between the D lines. A scale of wave-lengths is printed on each plate, and in no case does the error due to displacement of the scale amount to one part in fifty thousand. The wave-lengths of over 200 lines have been determined to within one part in five hundred thousand, and these serve as reference lines to correct any small error in the adjustment of the scale. The great value of such a map lies not only in the fact that it gives greater detail and is more exact than any other map in existence, but that it actually represents the real appearance of the spectrum in giving the relative intensities and shading of groups of lines so that they are readily recognizable. The photographs were taken with a concave grating six inches in diameter, and having a radius of curvature of 21½ feet, and the photographs were taken when the plate was placed directly opposite the grating; both the sensitive plate and grating being perpendicular to a line joining their centres, and placed at a distance apart equal to the radius of curvature of the grating, the slit being on the circumference of the circle, whose diameter is the distance between the grating and plate. With this arrangement, the spectrum is photographed normal for wave-lengths without the intervention of any telescopes or lens systems; and a suitable scale of equal parts applied to such a photograph at once gives relative wave-lengths.

Few persons have any idea of the perseverance and patience required to bring such a task to a successful issue. More than a year was devoted to preliminary experiments designed to discover the best mode of preparing the plates for the particular regions to be photographed. Hundreds of preparations were tested to find their influence on the sensitized plate, and the whole literature of photography was ransacked, and every method tested to the utmost, before the work of taking the negatives could begin.

The Rogers-Bond comparator, which has been already referred to as having been purchased by the university lately, is one of two instruments that were constructed in 1881 by Pratt & Whitney of Hartford, Conn. The general plan and requirements were made out by Prof. W. A. Rogers of Cambridge, and the drawings and details were worked out by Mr. George M. Bond, then a stu at Stevens institute. The comparator was desi for making exact comparisons of standard length. The other similar comparator is ov by the Pratt & Whitney manufacturing comp and is used by them in testing and constru their standard gauges.

The instrument consists essentially of two m scope carriages, which slide on two parallel c drical steel ways between stops, which ma clamped at any point. A carriage entirely dependent of the ways on which the microsc slide, supports the two bars to be compared, is provided with means of accurate and r adjustment, by which the bars may be successi brought into position under the microscopes, the lengths compared by the micrometers atta to the microscopes; or one microscope only i be used, and slid first against the stop at one and then against that at the other end. instrument also affords great facility in deter ing fractions of a given length with any de degree of precision. The instrument is one quiring the utmost skill in its construction, ar cost several thousand dollars to make it. A account of this remarkable instrument is give the Proceedings of the American academy of and sciences for 1882–83. F

NORTH CAROLINA COAL-FIELDS.

The coal-deposits of North Carolina have cently been examined by Dr. H. M. Chance,[1] u the direction of the North Carolina state boar agriculture, with the view of determining t commercial value.

There are two isolated triassic areas in N Carolina in which coal has been mined, — on Deep River, and the other on Dan River. Chance's explorations in the Deep River coal- consisted mainly in a re-examination of the outcrop, which follows the west border of the s and passes through Farmville, Gulf, and Car ton. The various sections obtained show th general there are two workable coal-seam this field, as was proven long ago in the E shaft and at several mines along the coal out The upper seam averages 2.5 to 3 feet, and lower 2 feet in thickness. In the Egypt shaf upper coal measured 4 feet, and the lower 1 10 inches; twenty-seven feet below the lo of these workable seams, another, 1 foot t was penetrated. At Gulf three workable s outcrop, but their thickness is variable owi

[1] *Report on the North Carolina coal-fields to the d ment of agriculture* [of North Carolina]. By Dr. Chance. Raleigh, 1885. 66p., 3 maps. 8°.

disturbances due to trap-dikes and faults. The dip of the coal-seams is in general S. E. 25–30°.

Several new analyses of the coal of this area are presented, some of them being of average samples from large quantities. The coal is 'bituminous,' as is shown by the following average of a large number of analyses: volatile matter, 30; fixed carbon, 54; ash, 12; sulphur, 3.6 per cent. At times the coal has been altered to a semi-anthracite, and even to a natural coke, by the heat of trap-dikes.

The expense of working the coal in seams 2 feet thick is estimated at $1.50, and in seams 3 feet thick at $1.20, per ton. In the mines of Tennessee and West Virginia, with which the North Carolina coal comes in competition, mining is carried on at the rate of about 65 cents per ton. Combining these figures with the cost of transportation, it is shown that there would remain a sufficient margin in favor of Deep River coal to command the market in eastern North Carolina. This is favorable to the development of the Deep River deposits: still the fact that these mines have not been worked for many years is significant.

The Richmond coal-field, which is of the same age and of the same general character as the Deep River deposit, but in which coal occurs in much thicker seams, and in general is of better quality, has also been a failure, when the mining operations of the whole field are considered. It is evident, therefore, that there must be some sufficient reason why mining in these fields, which are in close proximity to good markets, has not succeeded. Dr. Chance enumerates some of the more obvious difficulties that present themselves in the Deep River area: there are variations in the thickness and quality of the seams, faults, trap-dikes, presence of explosive gas, water, spontaneous combustion, and absence of coal from certain areas. Nearly all of these obstacles are probably much more difficult to surmount in these mines than in the great coal-fields to the west, with which the North Carolina coal comes in competition. To the present writer, who has recently examined all of the triassic areas south of the Potomac, it appears that the difficulty in the way of economical mining in the various triassic coal-fields arises mainly from the structure of the deposits. All of these areas are extensively faulted, and are traversed by an extended system of trap-dikes. Along the faults the coal has been so completely crushed that it is usually of little commercial value. At the same time, the continuity of the beds has been broken, and their dip disturbed and rendered irregular.

This wide-spread disturbance renders the expense of working the coal extremely uncertain, mainly on account of the difficulty of following faulted beds. The numerous trap-dikes that intersect the triassic areas north of the Potomac have caused disturbances which are even more injurious to the coal-deposits than the effects of faulting. The dikes are frequently accompanied by a displacement of the beds on either side, and also by an alteration of the adjacent coal. At times the coal in proximity to the dikes has been ruined by the heat; but in some instances, however, a natural coke has been produced which is more valuable than the unaltered coal. Trap-dikes more than a few feet thick are so expensive to penetrate that they are practically insurmountable obstacles when met with in coal-mines. This was the case in certain mines formerly worked at Gulf. Again, the trap sometimes penetrates the coal-bearing strata in intrusive sheets, approximately parallel with the planes of bedding, and in these even more troublesome to the coal-miner than when it forms vertical dikes.

A study of the numerous mining operations that have been carried on, commonly with failure, in the Richmond coal-field, would illustrate the peculiar difficulties to be expected in the Deep River basin. The lack of success in so many mining ventures in the triassic areas south of the Potomac, owing to the disturbances that have affected the coal, proves conclusively that mining should not be undertaken in the triassic coal-fields of the south without a careful preliminary examination with a diamond drill of the entire property that it is proposed to work. The quantity, quality, and position of the coal should be accurately determined before expensive mining operations are begun. With these precautions, it is probable that portions of the Deep River coal-field can be developed with profit, but it is safe to predict financial failure for those who begin mining with the expectation of working continuous coal-seams in the manner followed in West Virginia and Pennsylvania.

The coal-deposits on Deep River were also examined by Dr. Chance, who pronounces them to be valueless for commercial purposes.

This report will be of value to those interested in the coal-deposits of North Carolina, but it contains little that can be considered as a contribution to geology. I. C. RUSSELL.

THE AMERICAN FERRET.

ALTHOUGH the philosophical biologist measures the importance of a species by the light it throws upon the problem of the science which he cultivates, there are certain animals and plants which, while not intrinsically of unusual importance, enjoy a special prominence on account of their

brilliant coloring, the grotesqueness of their form, or their rarity. A rare species has the same interest for a collector of natural objects as a rare book for a bibliomaniac. Be its importance real or nominal, its rarity recommends it, because men tire of that with which they are familiar.

The American ferret (Putorius nigripes, Audubon and Bachman), of which we offer a representation, is one of the least known of North American mammals, and is but rarely met with in collections. It was described by Audubon and Bachman in 1851 from a single specimen, and a quarter of a century passed before our knowledge of the species was in any wise augmented. In 1874, Dr. Coues advertised his desire for specimens in certain sporting papers, and was gratified to receive for the Smithsonian institution several examples from different localities.

Since that time quite a number of specimens have accumulated in the national museum and some other establishments.

THE AMERICAN FERRET.

Of the habits and distribution of the black-footed ferret, we still know very little. The specimens thus far recorded are from Texas, Kansas, Nebraska, Colorado, Montana, and Wyoming. The species probably ranges over the greater part of that section of the United States lying between the Mississippi River and the Rocky Mountains.

The specimens of which the history is known were taken from prairie-dog holes; and Dr. Coues states that about Fort Wallace, Kansas, the species is said to be known as the 'prairie-dog hunter.' Dr. Hayden found the remains of a prairie-dog in the stomach of a ferret which he sent to the Smithsonian institution.

In his work upon the weasels, Dr. Coues established a special sub-genus, Cynomyonax, for the black-footed ferret, and in 1881 Hensel made the species synonymous with the Putorius Eversmanni of Siberia. It seems very improbable, however, that Hensel's view is correct.

The specimen figured was obtained for the Smithsonian institution by Capt. James Gillis, at Cheyenne, Wyoming. The head and body measure 19 inches (following the curves); the tail, including the terminal pencil, 5¼ inches. F. W. True.

A clergyman has just been committed to prison in England for seven days as a penalty for striking a constable. The assailant was coming out of his house, when the policeman, who happened to be waiting to serve a summons, laid the document on his arm. His reverence exclaimed, "You brute, how you did frighten me!" and struck the constable a violent blow in the face with a candlestick. In commenting on this case, the *Lancet* says that it should not be forgotten that in many instances the immediate effect of a 'fright' is to make the person startled strike out with any thing at hand. Some persons are paralyzed by panic: others are instantly roused to action in a way that does not involve volition. The blow is as much the result of the excitation as the knee-jerk produced by striking the patellar tendon, albeit the train of actions is more complex, and involves the exercise of that co-ordinative faculty which has been called the sub-consciousness. In stumbling we make certain movements with the feet, and clutch at any thing that may be within reach in a manner designed to prevent or minimize the effect of a fall. A good horseman will, 'instinctively,' as we say, take such precautions as will prevent his being hurt by a fall. The will is not *intentionally* active in these processes. The recognition of the danger, and the adoption of suitable measures, seem to occupy too short a time for thought.

SCIENCE.

FRIDAY, DECEMBER 25, 1885.

COMMENT AND CRITICISM.

ALL AMERICANS have been amused with the stories which have recently appeared in the newspapers, of the intense state of excitement to which the English people have allowed themselves to be roused by the elections just closed. There is, of course, good reason for the difference in American and English election manners in the prolongation of the agony which the protraction of the English elections entails. In the *Lancet* for Dec. 12 appeared an article on 'Deaths from election fever.' The writer takes the ground that the feebler minds of a community are those which take the most interest in politics. "This being so, it ought to surprise no one that a large sprinkling of the 'minds' subjected to the strain and excitement attendant on a general election should give way, or that in a certain proportion of instances brains should be so affected as to suffer those coarser injuries which end in speedy death rather than protracted mental disease." Is this to be accepted as a fair statement of the facts in England, and do we experience in the United States an increase in the number of deaths from brain-diseases at times of great political excitement?

WHILE THERE IS MUCH to rejoice at in the recent circular issued by A. C. Armstrong & company, concerning the *New Princeton review*, yet there is one paragraph that cannot but have a disappointing effect when read by those whose interest in philosophy is purely scientific, and not dogmatic or polemical. It is clearly implied that no philosophical articles, however meritorious, will be admitted into the *Review* unless they are in accord with the system of realistic philosophy, on which the venerable president of the college of New Jersey lays so much stress. From the point of view of science, this is an unfortunate determination. We have in the English language only one really scientific philosophical journal, and that is published in London. The *Journal of speculative philosophy* is excellent in its way, but it is not in the accepted sense of the word 'scientific.' Many of our other periodicals admit philosophical articles, but they are lost sight of amid the surrounding mass of theology, literature, and art. The *New Princeton review* had been eagerly looked forward to as supplying a want, as far as its philosophical department was concerned. Now its preliminary announcement disappoints this expectation. We repeat, that, from a scientific stand-point, it is unfortunate that this new magazine is to be a dogmatic philosopher and an organ, rather than scientific and critical.

MOST OF THE INTERIOR of New South Wales, which is occupied by the watershed of the Darling River, the main line of drainage of the Australian continent, is a great alluvial plain, with little slope in any direction, and no well-defined water-courses in a considerable portion. The fall of the Darling through much of its length is but a few inches to the mile. The soil is of salt or bitter lake formation. The industry to which a large portion of this territory is likely to be devoted is sheep-raising, provided a sufficient supply of water can be obtained without requiring the sheep to travel too long a distance. As droughts occur extending over periods of from one to three years, the solution of the problem of water-supply is vital to the settlement of the country. Since the soil is light and unstable, permanent dams cannot be constructed in the rivers without great cost, and the declivity is too slight to permit of water being conveyed by artificial channels or canals to any distance from the streams. It has been found by artesian borings that some of the beds of loose sand interstratified with the clays yield a large supply of fresh water; but the limited amount of research that has yet been made is not sufficient to assure the squatters that water can thus surely be found, and the search for water by that means is too costly and uncertain a process for the settlers. The construction of storage-tanks, to be supplied by surface drainage, has therefore been suggested. Under the arduous conditions imposed by the probability of long droughts, these earthen tanks should be made much larger than has been the practice heretofore. The smallest reservoir, to supply some eleven thousand sheep, pastured on an area of six miles square, would require the excavation of

10,000 cubic yards, at a cost of $4,000, and would hold 6,750,000 gallons of water. An evaporation of five feet in depth per annum, removing 2,800,000 gallons, would leave 3,950,000 gallons for the use of the sheep, — enough for one year, and perhaps eighteen months. To carry the sheep through a possible drought of three years, a tank of twice the capacity would be required.

In a recent number of the London *Times* appears more evidence of the interest of England in the conquest of Burmah, that a good trade-route with western China may be opened. After referring to the misguided ways of King Thebaw, who is held up as a weak individual, guided by a few ill-advised ministers of state, the *Times* refers to the future of the country in these words: "Whatever may have been the influences round King Thebaw, they cannot much affect the future of his kingdom. Mr. Bernard, the chief commissioner, will, it is stated, proceed at once to Mandalay, with a party of officials acquainted with the Burmese language. For the present, General Prendergast will administer the country. But when Mr. Bernard arrives, civil authorities will take charge of it, and rule it in the name of the empress of India. The question seems to have been carefully studied, and there seems to be no difficulty in framing a temporary organization for governing Upper Burmah. Our efficient Indian civil service is not to be embarrassed by the acquisition of a new province."

RAILWAYS IN BURMAH.

Mr. Holt S. Hallett recently addressed the members of the Scottish geographical society, his subject being 'A survey for railway connections between India, Siam, and China.' The conquest by England of Upper Burmah places the Burmese Shan states under her protection, and thus allows their peaceful and trade-loving inhabitants to expect a better commercial connection with that country. England is now placed in such a position that no political hindrance remains to prevent her driving the iron horse up to the gates of China, and opening up to trade the western provinces of that rich and prosperous empire. For the past four years Mr. Colquhoun and Mr. Hallett have deeply interested themselves in the subject of the expansion of trade by linking China and the intervening countries to India by means of railways. The valley of the Irrawaddy is bounded on the west by a range of hills which, as it proceeds southwards, spreads out into an entangled mass, touching the sea along the Bay of Bengal with many of its spurs. No railway can therefore be constructed, except at a prohibitive cost, from Calcutta along the seaboard towards Rangoon. Through the pass used by the Burmese in their invasion of Assam, there is a route which would suit admirably for carrying a railway from the Brahmapootra valley into the valley of the Irrawaddy, and then the railway could be joined, without meeting any great difficulties, to the Rangoon and Tonghoo line, having its present terminus at Rangoon. The height of the pass is not more than 2,500 feet above the sea-level, or 2,000 feet above the level of the Brahmapootra valley.

Owing to the many ranges that would have to be crossed, a railway constructed to connect any part of the Irrawaddy valley in Upper Burmah, or Lower Burmah to the north of Beeling, with western China, would be of greater length and considerably more costly than a line (proposed by Mr. Hallett) which has its terminus at Maulmain.

In considering the traffic which would be likely to arise from the construction of railways through the centre of Indo-China, Mr. Hallett said: "It will be well to remember, 1°, that although the population of our possessions in British Burmah is only 1-40th of that of our Indian dominions, yet British Burmah has 1-10th of the whole trade of India; 2°, that Upper Burmah, which since the rebellion of the Burmese Shan states has scarcely a million of inhabitants, still carries on a trade with us of about £3,000,000 sterling; 3°, that a million sterling of treasure is imported into Burmah each year more than is exported; 4°, that Chinese emigration has been shut out lately from America, Australia, and other places, and would certainly set into the fertile plains of Indo-China if it were encouraged and facilitated by the construction of railways; 5°, that already half the population in the delta of the Meh Nam is composed of Chinese and their descendants; 6°, that the great want of British Burmah is population."

The paying prospects of the proposed railways can be compared with those of the railway between Rangoon and Prome, which was opened in 1878. This railway, which is 162 miles in length, was made to connect the town of Prome with the seaport of Rangoon. It passes for fully two-thirds of its length through an unfertile country covered with scrub jungle. On the whole length of the railway there are not more than six villages, and the line is in competition with the admirable flotilla of steamers plying on the Irrawaddy River. Yet this line paid to the English government a net profit of 6 per cent last year upon the expenses of its construction.

BAD TIMES.

IN these days of many books, one gives a welcome to the man who can write a small book; but in this case the man is he whose work makes him the rival of two not often found together in the same comparison, — Charles Darwin and Henry George. Mr. Wallace, as a naturalist, disputes with Darwin the claim of having originated the theory of natural selection; while, as the defender of the nationalization of land, he also appears in the field where Henry George had been the most prominent figure. Like Simon Newcomb, who has lent the hours not occupied by severe mathematical studies to the service of political economy, so Mr. Wallace has turned from natural history to explain to us the causes of the depression in business which has in the years since 1873 become so unfortunately familiar to us all.

His definition of 'bad times' consists in "the low prices of goods, the number of men out of employment, and the numerous bankruptcies" (p. 14), thus showing the influence of that common failing in business circles wherein men think that high prices are in themselves good, and low prices bad. It is owing to this prevalent opinion that men are apt, even when they know better, to wink at any measure which promises higher prices, even though it be through increased quantities of money. Indeed, our silver dukes hold their vassals in obedience, to no small extent, by making them believe that demonetization of silver leads to a contraction of the world's money, and so to a fall of prices. When a man has a stock of goods on hand, he wants prices to go up, no matter how. This overlooks the fact that money as a medium of exchange is only a means to an end, or a road from one to another place. An increase of money may raise prices, but not the quantity of goods in the world. Doubling the trucks in a store does not double the goods which they are made to carry.

But the real distress from low prices arises from the fact that they once were high: and that obligations to a fixed amount, entered into when prices were high, must now be paid off when prices are lower. This is the painful process; and yet it is painful only because people, led away in the period of speculation by sanguine expectations, entered into obligations which they did not have the actual wealth to satisfy. They bought with an enlarged faith, that is, with an expanded credit; and when the panic came, they found out that they had only expectations, instead of real wealth, with which to meet their engagements. Into this truth our author takes us, with some natural traces of English insularity, by explaining the effect of foreign loans in producing the depression. In 1870–75 he claims that England furnished one thousand three hundred million dollars as foreign loans to Egypt, Turkey, Russia, Austria, Italy, and Spain; to Brazil, Peru, Chile, and Paraguay; and to Costa Rica, Mexico, Guatemala, Honduras, Japan, and the United States; and to English colonies. These loans left England in the form of exports; so that English exports appear to have been so unusually increased during these years, that they have never since been equalled. The effect on England was to unnaturally stimulate many manufactures. "But soon came the inevitable reaction. The vast amounts of borrowed capital were exhausted, and, instead of having a plethora of money to spend, all these countries had interest to pay; and the people being heavily taxed to pay this interest, their purchasing-power was diminished, and the demand for our goods suddenly fell off." These foreign loans being expended so largely unproductively in wars and extravagant uses, nothing remained as a permanent source of demand for England's goods, and so English exports declined, business became depressed, and men were left unemployed. In this chapter our author gets nearer the essential truth than in some other of his explanations of the 'bad times;' for the above conditions were not solely English, or true only of nations. Individuals and corporations were everywhere lending and consuming beyond all wisdom, out of all proportion to their real means of payment. After our civil war, that was what we were doing.

The other causes seem to be of value only so far as they lead up to the one already explained. From 1870 to 1884 "the expenditure of the six great powers of Europe has increased from £345,000,000 to £612,000,000, — an additional burthen of £266,500,000 a year. The population of these six states is now a little over 269,000,000; so that they have to bear, on the average, an addition of taxation amounting to nearly a pound a head, or about five pounds for each family." As this has come about owing to wars, or preparations for war, it explains how the wealth has been consumed unproductively. The author also estimates that *seven millions* of men are involved in producing for this wasteful expenditure, and reminds us of 'John Bull and his island,' when he says that "the moral arguments against war would doubtless be more generally effective if it were clearly seen that always and everywhere its direct and necessary effect is to produce more

Bad times: an essay on the present depression of trade, tracing it to its sources in enormous foreign loans, excessive war expenditure, the increase of speculation and of millionnaires, and the depopulation of the rural districts; with suggested remedies. By ALFRED RUSSEL WALLACE. London, *Macmillan*, 1885. 16°.

or less depression of trade." Seize an Englishman by his pocket, and you can convince his mind.

The flow of the rural population to the cities is pointed out as one of the causes of the great distress in the centres of population, because of the vastly greater competition for employment. Together with this movement he instances the fact that "from 1873 to 1884 the quantity of arable land in the country has decreased by considerably more than a million acres." These seem to be local causes, and have little effect on other nations; for they are probably the evidences of a re-adjustment of industries to new conditions, such, for example, as the great produce of American wheat districts. The ownership of land by great millionnaires, he argues, also works injury. In 1863–72 the fortunes above a quarter of a million were 162, but in 1873–82 they had increased to 208, — an increase of more than 30 per cent. But we do not regard these causes of general importance.

The book, in fact, only in its description of the evil effects consequent on speculation, and the mania for foreign loans, gets close at the real cause. But when he gets to his remedies, he does not hit very near the mark. As foreign loans, he thinks, are made chiefly for the glory of monarchs, and to aid in wars for the personal aggrandizement of ruling families, he would have England stand ready to aid the tax-payers in these borrowing countries whenever they revolt against the heavy taxation caused by the loans which they have had no share in spending. Speculative transactions he would discourage by high stamp-duties; and large fortunes should be prevented by a graduated income-tax. If our author were to extract the ever-springing sanguineness of human nature from the business-man, he would best prevent over-trading and the recurrence of periodic panics, but in scarcely any other way.

NIMROD IN THE NORTH.

In this book Lieutenant Schwatka has given a most entertaining story of hunting and fishing in the north polar regions. Seven chapters of the book have been devoted to stories of adventure with animals whose homes are within the arctic circle. Many of the stories told in the volume are similar to some found in the writings of Gerard de Veer, of the Barentz expedition; in the writings of Parry, Beechey, Hearne, Rink, Richardson, Rae, Kane, McClintock, and Hall; so that they are not entirely new; but Lieutenant Schwatka has added to them many interesting observations of his own, upon the haunts and habits of the land and water game of the regions he explored, which modify ideas derived from other writers.

Nimrod in the north. By Lieut. Frederick Schwatka. New York, *Cassell*, 1885. 8°.

The volume is illustrated with numerous faithful and lifelike pictures of the animals, birds, and scenery of the regions beyond the parallel of 66° 30′ north. This feature of the book will make it most attractive to the reader, but more especially to the younger generation, who will find much pleasure in having before them such excellent representations of the bear, reindeer, musk ox, walrus, etc., with which Lieutenant Schwatka's party had so many exciting and perilous adventures during their stay in the country between Depot Island and King William's Land.

The story of the sledge-journey to King William's Land, as told in this book by Lieutenant Schwatka, is unparalleled in arctic exploration. The vicissitudes of storm and intense cold encountered and overcome are most interesting and instructive. To one of less determination or of less hardihood, the journey must have failed; but the indomitable will and inexhaustible self-reliance set forth in the story made success certain where failure would have likely occurred to any one less gifted.

It is almost inconceivable that travel could have been practicable in a temperature of 83° below the freezing-point, or that no discomfort was felt at such times. But the credence of arctic explorers will be tested almost to its elastic limit, to believe that Lieutenant Schwatka's party, when in chase of musk ox, travelled at 'a good round dog-trot from nine in the morning until four in the afternoon,' making about forty miles in a temperature of 97° below the freezing-point, without suffering from the cold, but, on the contrary, that he felt at times uncomfortably warm!

The last two chapters describe the beginning and ending of a rather remarkable raft-journey of thirteen hundred miles down the Yukon River, in Alaska. This trip led to the discovery of several rapids, the passage of which was full of innocent adventure; otherwise there is but little in it to excite interest.

GEOGRAPHICAL NOTES.

Explorations in central Asia. — A letter has been received from Prjevalski, from which it appears that the Altine chain extends about 360 kilometres westward from Lobnor, then gradually declines, and terminates at the Cherchèn River. Westward from this point the principal range of the Kuenlun looms over the plains of eastern Turkestan. This intrepid explorer, after having explored all of the Kuenlun between the Yellow

River and the town of Khotan, was expected, and has probably arrived before this, *via* Aksu and Karakol, at Semirechinsk, the authorities of which district had received a call for forty camels to carry the collections made by the party.

Return of Lieutenant Allen.—Lieutenant Allen, of the Copper River expedition to Alaska, has arrived in Washington, where he will prepare his report.

Cameroons district, West Africa. — Rogozinski writes of the Cameroons district, West Africa, and especially of the elevated region or hill district, which has a relatively good climate when compared with that of the lowlands adjacent. The diurnal variation of temperature is rather large. At Likumbé, 2,500 feet above the sea, the morning temperature was 65° F.; at noon, 88°.5; and at evening, about 73°.0. At the coast, for the same hours, it was 79°.0, 84°.0, and 80°.0, respectively. Often on the mountains during the night the cold was quite sensible, the thermometer falling to 60°, and rising at mid-day to 87° or 88°. The principal languages of the hill country are the Bakwiri or Bakwillé, Bamboko, Isubu, and a jargon spoken at the coast. This is the most northern outpost of the Bantu family on the west. The dialects are all nearly related to the Dwalla, spoken on the Cameroons River. The villages are not composed of associated huts, as might be supposed. Generally the cabins are scattered through the chaparral, not more than two together. A certain number form a clan or group, with a chief and several elders as the government. The men are hunters, and gather palm-oil and rubber: all else is left to the women and children. They do not give their confidence easily, but when once given it is easy to guide them. Their game does not include the elephant, common in that vicinity, and rarely the leopard. The women gather plantains, ignamas, nuts, palm-oil, etc., which constitute their chief sources of subsistence. The little plantations are managed by the women and children. The soil is extremely fertile and productive. The real richness of this land is for agriculture. The houses are built of canes, and covered with mats. The domestic animals, including pigs, sheep, goats, and fowls, have free access, so that they are far from clean. Snakes, iguanas, and the small meagre dog of the country, are eaten. Slavery does not exist, but polygamy is allowed. The people are quiet, except for *vendettas*, which are the source of many small conflicts and most of their ills.

Trade-routes between Bolivia and the Argentine Republic. — The observations of Thouar in the region of La Gran Chaco have been renewed. The traveller has especially in view the establishments of trade-routes between Bolivia and the Argentine Confederation,— an object of much importance to both countries, and to commerce in general. The emperor of Brazil is also very much interested in any thing tending to improve communication between the interior countries. Thouar accepted an escort of twenty-five men with equipment, and left Buenos Ayres, July 31, accompanied by Lieut. Felix Guerber and Pilot Wilfrid Gillibert. They were about to enter the north Chaco, to trace its unknown portion and complete the charts, when last heard from. Just as they started, Thouar was informed that a party, under Ernest Haugge, engineer, of German birth, and a Bolivian escort, engaged in studying the route between the Sucre and the upper Paraguay rivers, had disappeared in the Chaco, having been carried off by the indomitable Tobas.

Colonization in the Argentine Republic. — Colonization in the Argentine Republic seems more flourishing than in other parts of South America. Some five to twenty colonies have been established in the Santa Fé district, occupying about 95 square leagues, which a few years ago were given over to the Indians. To-day they are cultivated by 1,359 families. A railway leaves Santa Fé, and traverses this region; another is projected from Rosario. The soil is of great fertility, and but little more than energy and good will are needed to acquire here, if not a fortune, at least ease and comfort. The district of Santa Fé has received 88 colonies during the last 30 years, and now has over 110,000 inhabitants.

An island lost, and another found. — The rock known as the Monk (Munken, Monaco, etc.), six kilometres southward from Suderö, Faroe Islands, has succumbed to the elements. This rock, some seventy feet high, and from certain points of view sufficiently resembling a cowled figure, was described by the earliest writers on the Faroes, and has served as an important landmark for navigators for hundreds of years. A dangerous reef, nearly covered at high water, alone remains to mark its former position. In contrast to above is the important communication recently received by the Merchants' exchange of San Francisco from our consul at Apia, Samoa, announcing the upheaval of a new island in the track of vessels from California. This island was estimated by the officers of the steamer Janet Nicol as two hundred and fifty feet high, and two miles long north by west and south by east. The steamer approached to about a mile and a half from the crater, bearing west by compass. No bottom was found here at one hundred fathoms, but reefs extend from the extremities of the island, about a mile and a half in either direction. The locality

in a general way is off the Celebrass shoal, about forty miles from the Tonga Islands, toward the Fiji Islands. Its position is approximately in latitude 20° 28′ south, and longitude 175° 21′ west from Greenwich. Further details are expected by another steamer. The island was photographed by the British consul to Samoa, who was a passenger.

ASTRONOMICAL NOTES.

Harvard college observatory.— Professor Pickering's annual report was presented to the visiting committee on Dec. 3, and shows most gratifying progress in the work, in spite of the serious curtailment of the income of the observatory during the past year. The fifteen-inch equatorial is still devoted largely to photometry; and, besides a large amount of routine work accomplished, a series of observations of the temporary star which recently appeared in the nebula of Andromeda was obtained. Professor Rogers's excellent work with the meridian circle continues, and the reduction of his zone is nearly ready for the press. The meridian photometer also has been in active operation. By the aid of the Bache fund an important investigation has been undertaken in stellar photography, which has already been referred to (*Science*, vi. 443). Mr. Chandler's work with his almucantar we have noticed from time to time, and we look forward with much interest to the publication of a detailed description and theory of the instrument, which it is understood he has prepared. The telegraphic distribution of important astronomical discoveries, for which this observatory is the American centre, has been successfully continued under the supervision of Mr. Ritchie.

The Lick observatory.—The Clarks have made wonderfully rapid progress with the crown-glass disk of the immense three-foot lens for the Lick observatory. The work of grinding was begun on the crown-disk about two months ago, and already they are able to set up the lens for examination by artificial light. The flint-disk has been practically ready for some time, and, with continued favorable progress, they hope to finish the objective by the autumn of 1886. It has not yet been decided who is to make the mounting for the instrument, or the dome which is to cover it. We notice that the thirty-inch objective for the Nice observatory has just been finished by the Henry brothers, and that it has been sent to M. Gautier, who has charge of the construction of the equatorial; the whole to be mounted at Nice in April, 1886.

The Biela meteor-shower. — Reports from Europe show that we in this country entirely missed the thickest part of the meteor-shower of Nov. 27, as it had dwindled to comparatively insignificant proportions when our twilight came on. From various places in England and on the continent, where the sky was clear on the 27th, come reports of brilliant showers, sometimes too rapid for counting, and in many cases exceeding sixty per minute for a single observer. They were also very bright, and left trains continuing visible in some cases as long as 30ˢ, and frequently appeared almost simultaneously in bunches of five, eight, or ten. These were all early in the evening for European longitudes, and we shall have to wait for reports from farther east, in Arabia or India, perhaps even from Dr. Doberck at Hongkong, before we can be sure that we have heard of the maximum activity of the shower. This seems to have been well heralded in advance. The earliest observations thus far reported are by Mr. Barnard of Nashville, Tenn., who observed twenty or thirty meteors from the Biela radiant during an interval of two or three hours of clear sky on the evening of Nov. 25; and both he, and Mr. Denning of Bristol, England, counted them at the rate of one hundred or more per hour on the evening of the 26th. On the 27th none of the comets in this country appear to have exceeded two hundred or three hundred per hour for a single observer, and Mr. Denning reports that those of the 28th were very small and insignificant in a clear sky at Bristol.

New star in Orion.—A complete set of observations of the new star discovered by Mr. J. E. Gore, an English astronomer, on Dec. 13, was obtained at Harvard college observatory on Dec. 16, — the very evening on which the despatch was received from Lord Crawford, — settling the non-identity of the star with D.M. + 20°, 1172, the star named in the despatch. A meridian circle observation by Professor Rogers gave for the position of the *nova* R.A. 5ʰ 49ᵐ 4ˢ.25: Dec. + 20° 9′ 15″.6. Professor Pickering's photometric measures made the magnitude 6.2, and the spectroscope showed the existence of bright bands. Two excellent photographs fixing the position of the star with reference to neighboring stars were obtained, and one photograph of the spectrum. The indications are suggestive of the new star being a long-period variable, and there was a slight suspicion of a diminution in magnitude during the first six or seven hours it was under observation.

METEOROLOGICAL NOTES.

An unusual tornado. — The Alabama weather-service report for November describes the tornadoes that occurred on the 6th of that month. At Decatur the storm is reported to have come

from the south-east, a very unusual direction for tornadoes. The report concludes with a well-emphasized note.

Meteorology in New England. — The Bulletin of the New England meteorological society for the same month is based on reports from 136 observers. The precipitation is found to be 0.96 inch more than the average for ten or more Novembers at 31 stations, and the temperature is 2°.5 above the average. Storms on the 1–3d, 5–9th, and 22–29th, were the chief disturbances of the month. Wind-velocities by anemometer record are given for thirteen stations. Blue Hill had a maximum velocity of 65 miles an hour from the south-east during the storm of the 25–26th, with a total run of 15,389 miles for the month. The Eastport, Boston, and Block Island records for the same are 45 and 8,513, 46 and 9,338, 47 and 13,344, respectively. The tides during the last of the three storms were very high, owing to the concurrence of strong easterly winds, with the time of new moon and the moon's nearest approach to the earth. An increase in the number of stations around Brattleborough, Vt., is noticeable on the map.

Prediction of tornadoes. — A lecture on 'Tornado study' was recently delivered before the Franklin institute in Philadelphia by Lieut. J. P. Finley of the signal office. Probably no one in the country is more conversant with the facts and features of tornado occurrence than Lieutenant Finley, who has made a special study of these destructive storms for a number of years past. Their peculiar characteristics were described, and an account was given of the fifteen hundred volunteer tornado reporters who observe and report on these storms in all parts of the country, according to a plan devised by Lieutenant Finley. It was also announced that predictions of tornadoes are now attempted successfully, although they are not yet published. A dangerous attitude of weather conditions for the eastern middle states was recognized in the morning of Aug. 3 last, and in the afternoon tornadoes occurred at Philadelphia and thereabout.

Cold waves. — A signal-service note, xxiii., is a preliminary study of 'Cold waves and their progress,' by Lieut. T. A. Woodruff. They are found to follow an area of low, and to precede an area of high pressure, but their cause is not considered. Within our territory they nearly always appear first at Helena, Montana, and it is concluded that "they have their origin in the vast regions of ice and snow near the arctic circle far to the north of our stations." It is possible that records from the British north-west territory might disprove this conclusion; for in the winter, when the cold waves are most frequent, it is not always the polar regions that are coldest. The waves are found to move in different ways: 1°, directly eastward, over the great lakes and across New England, not being felt south of the Ohio valley; 2°, south-easterly, covering the entire country in their progress; 3°, southerly, from Montana and Dakota to Texas, thence through the Gulf states, and finally north-eastward over the Atlantic states, such waves being sometimes felt at St. Louis and Shreveport before reaching St. Paul and Chicago. The number of waves belonging to the three classes during the first six months of the years 1881 to 1884 was 22, 47, and 19. The second class thus appears more frequently than the other two combined. Fifty per cent of the waves appeared simultaneously at Bismarck and Helena. They generally reach Omaha eight to sixteen hours after their appearance at Helena, the distance being 880 miles; St. Louis, 24 to 32 hours, distance 1,030 miles; Galveston, 24 to 40 hours, distance, 1,600 miles; Nashville, the same; Buffalo, 24 to 48 hours, distance 1,750 miles; Washington, 32 to 56 hours, distance 1,953 miles. The difficulty in the prediction of the waves is the same that embarrasses the prediction of storm-centre tracks, for the former follow the latter. There has as yet been no tabulation published by the signal office of the conditions attending the early appearance of areas of low pressure, which afterwards take different directions in crossing the country. A special description is given in the note of the cold wave of March 18, 1883, in which the fall of temperature in twenty-four hours was generally 20° to 40° over the country. The most marked falls of temperature follow well-developed storms, and accompany an area of abnormally high pressure.

NOTES AND NEWS.

UNDER the will of the late Henry N. Johnson, and by the death of his widow in February, 1885, the Academy of natural sciences of Philadelphia, named as residuary legatee, has come into the possession of his entire estate, valued at $51,761.40. The present annual income from the productive portion, less taxes and water-rent, is $1,434.82.

— In many respects this is a golden age for children. This is true in the matter of school-books no less than in children's literature. In the 'new eclectic series of geographies,' Van Antwerp, Bragg & Co. have attempted to make the elementary study of geography attractive to children, and presumably with success. Their 'Complete geography' is excellent in its fulness,

its arrangement, in the satisfactory manner in which physical phenomena are described and explained, and in its general accuracy. Their 'Elementary geography' is equally well adapted to infantile minds. The illustrations of both editions are well selected, and are beautifully executed. The maps are modern, and are well adapted to the purposes of instruction. On the whole, the orography — the element with with which map-makers have the most difficulty — is fairly, and in some regions excellently, expressed. The registering of the colors on the maps can be very much improved.

— Dr. Daniel G. Brinton of Philadelphia has been announced as laureate of the Société américaine de France for 1885, and has been awarded the medal of the society for his works on the aboriginal languages and mythology of America.

— At about 10.12 P.M. on Dec. 10, a sharp shock of earthquake was felt in Victoria, B.C. It resembled the rapid roll of a heavily laden truck along a paved street. The vibration lasted from ten to fifteen seconds. At New Westminster the shock was felt at precisely the same time, but lasted about forty seconds.

— An atlas of Japan, in seven sheets, is announced by Justus Perthes. Each sheet will be on a scale of 1 : 1,000,000, and the atlas will be accompanied by a sketch-map on a scale of 1 : 7,500,000. Four of the sheets have already appeared, and the others will be issued during the coming year.

— The new balloon constructed by the Meudon aëronauts will be directed, says *Nature*, by a steam-engine, as advocated by M. Henry Giffard. Electricity will be quite given up, owing to its want of power for continuous action. From the reports to be published in the next number of the *Comptes rendus*, it appears that a velocity of six metres per second was obtained.

— Mr. Gaurel, at whose sole expense the late expedition to the Kara Sea, under Lieutenant Hovgaard, was undertaken, intends, provided his enterprise be seconded by the government, to send his steamer Dymphna next summer on an expedition, under an officer of the Danish royal navy, to the east coast of Greenland to explore and lay down the coast-line between 66 .08, the farthest northward point attained by Captain Hohn's expedition, and 70°.

— On examination of the extensive series of stellar photographs obtained at the Harvard college observatory, it appears that on Nov. 7, 1885, a photograph was taken of the region in which the new star is now visible. The star does not appear upon this photograph, which shows that at that time it must have been at least half a magnitude fainter than at present.

LETTERS TO THE EDITOR.

What has the coast survey done for science?

The contributions of the coast survey to general scientific knowledge in America may be said to begin with the year 1844, when Prof. Alexander Dallas Bache succeeded to the superintendency, on the death of Mr. Hassler, in December, 1843.

Mr. Hassler had given all the active energies of his life to a successful inauguration of a work of which few but himself realized the extent, or had any idea of what was implied in a 'survey of the coast of the United States;' and he came from Europe to this country at the beginning of the present century, when our country was still barely recognized among nations, and its few and ablest men were too much engaged in meeting and solving the practical problems of existence for the nation generally, and for themselves individually.

The number of men at that time who had made their mark as original investigators and thinkers in the different branches of astronomy, chemistry, mathematics, and physics, were so few that they might be counted upon the fingers. A few of the associates of the illustrious Franklin, among them Rittenhouse, Ellicott, and some others of the American philosophical society of Philadelphia, were joined by others from abroad — men like Priestly and Gallatin — in correspondence with men of like pursuits in England, France, and Germany, and were slowly and quietly laying the foundation for the building-up of a spirit of scholarship and physical inquiry, which rapidly developed after peace came finally to the country, in 1845, producing such men as Bowditch, Nicollet, and many others.

Mr. Hassler came to this country accredited as a man of learning and ability by the French academy. Being a native of Switzerland, he became intimate with his countryman, the eminent statesman Albert Gallatin, who was at that time secretary of the treasury under President Jefferson. The President had himself been given greatly to philosophic studies, and had, while resident in France, been the companion and friend of many of the most eminent men of science in that country.

It was through Mr. Gallatin's active and powerful aid that the idea originated by Mr. Hassler, of a great general 'survey of the coast of the United States,' was brought to Mr. Jefferson's notice, and his powerful aid secured in obtaining the passage of the act of February, 1807, which is still the legal basis of its existence.

Obstacles of various sorts arose in the way of carrying the act into execution. Chief among them was the war of 1812–15 and its consequent debt, crippling the means of the nation. Started in 1816, it was shortly after transferred to the navy, where it languished until, in 1834, it was re-transferred to the treasury department, where it has ever since remained.

The principle of organization adopted (and still adhered to, so far as practicable) was carried forward by Mr. Hassler under many difficulties, which were brought to the notice of congress, and resulted in the reference of the whole subject to a committee of

investigation, of which the late Hon. Caleb Cushing was one of the principal members. The result was "legislation creating a mixed board, from the coast survey, army, and navy, which adopted the plan of re-organization," in 1843. This, on approval of President John Tyler, had the force of law, and under it the survey has been conducted. The following extract from the report of the superintendent for the year 1849 describes the practical working of the system: —

"The re-organization of the coast survey, under legislative authority," in 1843, embodied all the experience obtained up to that date, both of trials which had succeeded, and of others which had failed: it confirmed and gave the force of law to the union in our corps, which has gradually grown up, of civilians, officers of the army, and officers of the navy, serving under a neutral department, under which alone they could be united; namely, that having control of matters relating to commerce and navigation. It is easy to see, that, without a permanent (civil) nucleus for such a work, the objects and aims must be wavering and unsteady, the methods wanting in uniformity from year to year and from party to party, and the results heterogeneous in kind and in form. Confusion and waste would result from such an organization, and the survey would in time be abandoned. The scientific parts of such a work require diligent study and devotion to mathematical and physical science, to grasp them in their various bearings; and it is not too much to say, that, unless such a work came up to the demands of science and the scientific men of the country, it could not long stand. That the theoretical knowledge acquired at the military academy should be reduced to practice in the survey by those officers of the army who have an inclination to similar pursuits, to its advantage as well as their own, will readily be seen; and, up to the point where details would interfere with the duties of the arm to which the officer belongs, congress has conferred upon the work a right to seek his services. The war department judges whether they can be properly granted or not.

"The law of 1843 very properly limited the services of the officers of the navy to the hydrographic parts of the work, — the portions which have a professional bearing, and towards which the inclination of a nautical man may turn with professional pride. Experience has fully shown the advantages of this organization in general. The tendency resulting from the variable elements (the army and navy) is nevertheless, at times, to lessen the results produced by the necessity for turning aside from actual work to give instruction, and from the loss of the experience acquired at the expense of the survey by the removal of officers — caused, no doubt, by the exigencies of their proper service, and yet reacting severely upon the survey. The experience and knowledge of Humphreys, Johnston, and Prince, of the army, and of Davis, Patterson, and Porter, of the navy, cannot readily be replaced: a detail may be filled, but the knowledge immediately available is not supplied."

Mr. Hassler died in December, 1843, just as this system went into operation. He had never realized the enormous advance which the country had made in every department of industry and learning in the thirty-six years which had gone by since the passage of the law of 1807. To his mind we had then to look abroad not only for all appliances for scientific research, but also for the men to use them. The late Mr. Thomas McDonnell, so long in the coast survey, informed me, that, so late as 1836 and 1837, he was the only man in Mr. Hassler's party who habitually spoke the English language. But in that period Bowditch had risen to the zenith of his reputation; men like Peirce, Henry, Bache, Walker, Morse, and many others, had come forward, and placed American science upon the enduring basis which has ever since been maintained and extended.

From among these eminent men, Professor Bache was selected, by almost unanimous consent of the learning of the country, to succeed Mr. Hassler at the head of a work then recognized as the greatest, as it was almost the only, scientific work of the country. The pressure upon President Tyler for his appointment was so great that he was obliged to yield to it, although he was opposed by the then secretary of the treasury, Hon. John C. Spencer, who preferred another person, but who soon recognized the remarkable fitness for his position shown by the new superintendent, and in less than six months became his firm friend and supporter.

From this time forward the work of the coast survey was rapidly extended; its increased usefulness was recognized by congress by steadily increasing appropriations, as the work was extended to all parts of the coast. Between 1844 and 1849, or in the short period of five years, the extent of the coast line of the United States was doubled by the addition of Texas, and the Pacific coast from San Diego to Vancouver. But such was the elasticity of the wise method of organization formulated in 1843, that the work expanded to meet the calls upon it, and surveying parties were upon the shores of Texas in 1847, and in California in 1849. The history of the work from that time forward, and during and since the civil war, has been one of which every man connected with it has reason to be proud. It has been foremost in every matter connected with the interests it has had in charge. It has won the approbation, freely and officially expressed, of every enlightened government of the civilized world.

In 1872, for the first time, its work was extended to the interior, and it was recognized by law as the 'coast and geodetic survey.' Other scientific works have been authorized, and some of them have appeared to come in conflict with the duties assigned to it, and seeming to belong to it. With these it has sought or shown no conflict, but has freely rendered to them every possible aid in its power. This is not the place to discuss or further allude to these points. The historical *resume* here given, of the early inception and progress of the work under its most renowned chief, has been necessary to a proper understanding of the matters now to be brought forward in answer to the question asked me, 'What has the coast survey done for science?' to which I now attempt a reply.

Longitude.

In 1844 the difference of longitude between any point in Europe and any point on this continent was uncertain. Then, as now, the meridian of the Royal astronomical observatory at Greenwich, England, was the reference-point from which longitude was reckoned by English-speaking nations.

One of the first matters taken up by Professor Bache was to obtain a correct difference of longitude between Greenwich and some central point in the United States connected with the survey of the coast.

The services of the best American astronomers were enlisted in collecting and reducing all astronomical observations bearing on the matter. Measures were at once taken for obtaining a different and better class of results by transportation of chronometers on the Cunard steamers between Liverpool and Boston. This method so far superseded others, that it led to the final adoption of the observatory at Cambridge, Mass., as the point of reference for all coast-survey longitudes. Its director, Mr. W. C. Bond, also had charge of all chronometers used in the Cunard steamers.

While this was in progress, other observers at Philadelphia and elsewhere made and reduced observations of occultations and moon-culminations for the same purpose. These observers did not belong to the survey, but were paid small sums for copies of their observations and reductions. By this means the coast survey, under its enlightened head, assisted in bringing forward many men who have since become well known, but who were held back for lack of pecuniary means and instruments, both of which were supplied by the coast survey.

The Morse telegraph had just come into use in 1844. Its application to the purpose of determinations of exact differences of longitude was suggested by Professor Bache to the famous inventor before even the success of the telegraph itself had been commonly accepted as secure. Experiments were made in 1845 and 1846 as soon as lines were established, and in 1846 the first recorded observations were made between Washington and Philadelphia. The ease and precision of the method attracted the attention of all American astronomers, and all attempts at improving it were fostered by Professor Bache. Each year brought improvements in the methods of observing and recording, and greater precision and refinement in the character of the results. First came the disk of Professor Locke of Cincinnati; next that was improved upon, and the clock-beats by telegraph rendered automatic by Prof. O. M. Mitchell, by which an astronomical clock in Cincinnati was made to beat and record its time both audibly and graphically in other and many distant places at the same moment. Finally the invention and perfecting of the 'chronograph' brought the whole to its present state of perfection. As soon as the Atlantic cable became a success, in 1866, it was at once employed by the coast survey to obtain a precise difference of longitude from Greenwich, and this was repeated at three different periods and by different cables and observers in 1870 and in 1872, with an extreme discrepancy of only five-hundredths of a second of time, leaving nothing further to be desired. In 1852, on the death of Assistant S. C. Walker, Prof. B. A. Gould succeeded him as assistant in charge of telegraphic longitudes at intervals until his resignation in 1868. During this time the development of the method was carried forward by him with his usual zeal and energy. His last great work was the inception and execution of the first telegraphic determination of longitude from Greenwich through the cable, then just laid, in the fall and winter of 1866. The difficulties then encountered and overcome (much greater than in any subsequent expedition) are fully detailed in his elaborate report, printed as appendix No. 6 to the coast-survey report for 1867.

There have been printed between 1846 and 1884, by the coast survey, 26 reports on astronomical methods of determining longitude, 8 reports on chronometric methods, and 30 on telegraphic methods; in all, 64 papers, by Peirce, Walker, Bond, Gould, and Hilgard, being a larger mass of contributions to our knowledge of this important practical and scientific question than has been made by any other one nation within the same period.

This application of the telegraph to the determination of one of the two most important geographical problems known to science has completely revolutionized all previously known methods. It is in use all over the civilized world, and is everywhere known as 'the American method.' It was begun, and has been brought to its present state of perfection, by the coast survey.

The Gulf Stream.

The exploration of this 'river in the ocean' was commenced in 1844, and has been continued ever since under coast-survey direction. Apparatus was used for obtaining temperatures at such depths as could be obtained. In 1846 the separation of the Gulf Stream into two branches was discovered, and was dearly paid for by the loss of a brilliant officer of the navy, brother of Professor Bache, who was swept from the deck of the vessel he commanded in a storm off the coast of North Carolina. The surveys have been kept up and continued, as means have been afforded, from that time to the present.

The ingenuity and skill of the naval officers who have been at different times attached to the survey have resulted in improvements of means and methods, until depths exceeding five miles have been reached; and it has been satisfactorily shown, that, underneath the warm surface-water of the Gulf of Mexico and the Gulf Stream, the temperature of the water steadily diminishes until it is nearly ice-cold at the bottom. The inventive genius of Commanders Bartlett and Sigsbee, U.S.N., while engaged in this duty under Superintendent Patterson, has left little for their successors to do but to follow in the way they have marked out.

Early in this work, or before 1850, the enlightened and liberal view taken by Superintendent Bache, of his obligations to science, led him to take up an apparently different department of science in authorizing dredging to be executed at great depths, that the nature of the inhabitants of the deep sea might be ascertained. This gave to America as a citizen one of the most eminent naturalists of the world. The late Prof. Louis Agassiz has left on record his statement that his determination to become an American citizen was decided on in consequence of the enlightened liberality of Prof. A. D. Bache, superintendent of the U. S. coast survey, in offering him the facilities afforded by the surveying parties and vessels of the work for conducting his investigations upon the Atlantic and Gulf coasts. The magnificent models of the bottom of the ocean in the Bay of North America and the Gulf of Mexico, made under direction of Professor Hilgard, and that of the Caribbean Sea by Commander Bartlett, U.S.N., are results of the long-continued, earnest, and effective labors of the various parties of the coast survey, and the ingenious efforts of the officers of the navy, on coast-survey service, who commanded them.

Tides and currents.

Systematic observations of tides and currents were begun in 1844; and in 1845 the very difficult problem of tides in the Gulf of Mexico, where only one tidr

occurs in each twenty-four hours, was attacked. Staff-gauges were first used, but were shortly supplemented by an ingenious self-registering gauge, invented by Mr. Joseph Saxton, of the weights and measures office, by which a continuous automatic record of the rise and fall, with effects of winds and storms, was kept up. These were gradually multiplied by similar instruments at carefully selected points along the coast, until, in 1854, sufficient data had been collected and reduced to form a theory on which was based tables of predicted tides for every day in the year, and for all principal ports upon the Atlantic and Gulf coasts. This contribution of the coast survey to the practical necessities of navigators has been continued and gradually improved up to the present day, and large editions of these little books are yearly printed and eagerly sought for. Similar tables for the western coast, founded on similar observed data, were first published in 1870, and are also continued.

A very considerable contribution to science occurred in 1883, when the tide-gauges of the coast survey at San Francisco, Alaska, and Honolulu, all indicated upon their automatic record the effect of the great earthquake at Krakatoa, in the Straits of Sunda, full one-quarter of the circumference of the globe from the nearest tide-gauge. These earthquake-waves, greatest at Honolulu, continued to impress themselves upon the records for between four and five days. Photographic copies were sent to the Royal society at London by their request.

Another contribution to science in this department has been the invention and daily use, in the coast-survey office, of a tide-predicting machine, which, being set to represent certain elements obtained by not less than a yearly observation at any place, will, by simply turning a crank, predict the times and heights of future tides at that place for the ensuing year. This invention is by Prof. William Ferrel, formerly of the coast survey, and now of the signal service.

Physical hydrography.

Tidal currents, and the laws governing them, have been studied, and the best methods of so controlling them as to aid navigation by deepening channels have been applied in all parts of the Atlantic and Gulf coasts; the basis of action being the coast-survey maps, and the organization of each commission appointed to advise the best action being precisely that of the coast survey. Such commissions have acted, with the most useful effect, in Portland, Boston, Providence, New York, Philadelphia, Wilmington, N.C., Charleston, Savannah, and other places. In all cases the commission has consisted of one engineer officer of the army, one naval officer, and one coast-survey officer. Usually the naval officer has been one who had several years of experience in hydrography upon the coast survey.

Prof. Henry Mitchell, an assistant in the coast survey, has made physical hydrography his special study, and has become one of the recognized authorities upon the subject in this country. He is, and has been since its formation, a prominent member of the Mississippi River commission. Of the one hundred and seventeen publications by the coast survey on the subject of physical hydrography between 1845 and 1883, twenty-seven are by Professor Mitchell, and all have a direct bearing upon the best methods of improving the commerce and navigation of the principal ports and navigable thoroughfares of the Atlantic and Gulf coasts.

Magnetic observations.

In the early surveys of this country, the compass, with its magnetic needle, has been the principal instrument used. It still continues to be largely used, especially in new settlements, and portions of the country where land is of small value. In more populous portions, where land has become valuable, it is being steadily discarded for instruments of greater precision. As a consequence of its great use, observations to determine the general and local magnetic variation had been made in many places from the earliest period of the country's settlement. As our knowledge of the subject increased, and the laws governing the all-pervading magnetic principle came to be better understood, observations not only for magnetic variation from the true north were increased, but apparatus was invented and largely used for observing the two components of the magnetic force, and obtaining the total intensity with which it acts upon a freely suspended magnet in any locality.

Observations of this character were commenced in the coast survey in 1833, and have been kept up ever since, being vigorously pursued since 1844. Small amounts were also paid to outside observers, and in some cases instruments have been loaned on condition of furnishing copies of their observations. Since Professor Bache's death, this important department of coast-survey scientific work has been in the hands of Assistant C. A. Schott, who has, with indefatigable labor, made it specially his own. He has collected and digested all detached observations from every quarter of North America. The tables and maps prepared under his direction, and published by the coast survey, have been and are more largely called for than any other publications; and the expressions of thanks for and appreciation of the valuable practical aid they have given, have been received from engineers and surveyors throughout the entire country. Seventy-two publications have been made by the coast survey on terrestrial magnetism, of which fifteen are by Professor Bache, and forty by Assistant Schott.

Astronomy as applied to geodetic surveys.

When Professor Bache became superintendent of the coast survey, in 1844, it possessed no instrument for precise determination of latitude superior to a sextant. Lieut. Thomas J. Lee and the writer spent a large portion of the season of 1844 in vain endeavors to obtain reliable results from the larger instruments in its possession, which still remain in the archives to mark the progress made in this branch of 'practical astronomy.' Only one small portable transit instrument for observing time belonged to the survey. As rapidly as possible instruments of a higher order were introduced, and better methods of observation and reduction began. The zenith telescope was introduced. This instrument, invented for a different purpose, had been ingeniously applied by Capt. Andrew Talcott, Corps of engineers, U.S.A., to a method of determining latitude, of so delicate, precise, and simple a character, as to leave nothing to be desired in these respects. Just at that time the British association for the advancement of science had published their catalogue of places of over seven thousand stars, chiefly in the northern hemisphere,

which made Captain Talcott's method easy of application for field use at geodetic stations. Professor Chauvenet says of the zenith telescope. —

"The method of finding the latitude by this instrument, now known as Talcott's method, is one of the most valuable improvements in practical astronomy of recent years, surpassing all previous known methods not excepting that of Bessel by prime vertical transits both in simplicity and accuracy."

Soon it was found that observations by Talcott's method, with the zenith telescope, were superior in precision to the places of the stars observed as given in the catalogue. Hence arose a demand for better star-places: and the observatories of the country were called upon by the coast survey to furnish them, the coast survey paying for the labor involved in observation and reduction. The directors of the observatories, finding their instruments and means insufficient for the desired results, applied themselves to procure better: and thus again the coast survey, by the stimulus it gave to astronomical means and methods, added another to its list of aids given to the advancement of American science. As a consequence, in a large part due to this cause and to those mentioned in what has been said respecting telegraphic determinations of longitude, we have at present catalogues of star-places of a degree of precision of the highest order.

In 1867, Assistant George Davidson invented and added to our means an ingeniously contrived instrument for observing both latitude by the Talcott method, and local time as usual with a transit instrument, by one and the same instrument. This 'combination instrument' is now largely and successfully used.

Geodesy.

All contributions by the coast survey to science in this department must, of necessity, be practical in their character, since the principles involved in the application of all geodetic methods are as old as Euclid.

Improvement in accuracy of geodetic instruments of every class, and especially in improving their precision while diminishing their size and weight, has been marked and steady from 1844 to the present time. More precise observations are now obtained with a theodolite having a graduated circle of twelve inches diameter than could be had in 1844 with instruments having circles of twenty-four and thirty inches diameter. When it is considered that these instruments are transported to the highest summits of North America, often upon the backs of mules, it will be perceived what a gain to precise scientific observation is obtained by the diminishing of weight.

The substitution of the observation of directions for that of angles is another gain to science. The change of the problem to be ascertained by observation, from 'What is the most probable measure of a certain angle?' to 'What is the most probable direction of a certain line?' has added greatly to ease of observation, and precision in results.

Methods of determining azimuth, or the angle made by any geodetic line with the meridian of the place of observation, have been simplified and multiplied, and increase of precision obtained, with less labor and in less time.

Wherever it had become necessary to use artificial elevations for geodetic observations, it had been usual in Europe, India, and America, to use repeating theodolites which only required temporary stability, not usually exceeding a couple of minutes at a time. For important primary stations, brick towers were erected: or, if wooden towers were used, they were carefully enclosed to protect them from the sun's action. But in 1858, Professor Peirce, then superintendent of the coast survey, authorized the use of open wooden insulated tripods for supporting the larger direction instruments of the coast survey.

The legs of the tripods were exposed to the full action of the sun's rays, while shaded by light cotton screens from the force of the wind. The motion of the wooden tripod caused by the action of the sun's rays was eliminated from the result by the method of observation adopted. Since that period the largest and most delicate theodolites have been successfully used upon cheap wooden structures in many parts of the country, and money and time saved with no falling-off in precision.

Within the past ten years the old methods in vogue a century ago, of observing upon intensified lights at night, have been renewed, using both magnesium and coal-oil reflector-lamps, and much time has been saved by adding to the number of hours when observation was possible. The precision of the work has also gained by night observation.

Topographical methods have also been improved. The use of the plane-table has been extended, and this unrivalled method of executing precise maps, by making and correcting them upon the ground itself, is now regularly taught in some of our scientific schools, as are other coast-survey methods of observation, reduction, and computation. In every institution of learning in this country, at Cambridge, New Haven, New York, Ithaca, the coast survey has left its impress, and everywhere for good.

The coast survey is as well able to continue its course now as it ever has been. Its officers are as able and zealous as they were twenty years ago. Its form of organization has proved itself well adapted to its needs, and, with some essential changes to cause it to conform more closely to the changed external conditions, it may do the country thorough and vigorous service. It is to be devoutly hoped that the opportunity may be given it to prove what it is made of, and that its force may be more concentrated, instead of being broken up and scattered.

C. O. Boutelle,
Asst. U. S. coast and geod. surv.

An old work on political economy.

The last numbers of *Science* brought to my memory the time of 1842, when I studied in Paris, and had, by the request of my father, professor of political economy, to procure for him a large number of books and tracts on political economy. Some of them were very rare, even in the libraries, and I had to content myself with making out a very full and detailed account of their contents. Among them was, 'Traité de l'oeconomie politique, dedié au roi,' etc., by Antoine de Montchretien, seiur de Vateville à Rouen, 1615 pet. 4°. The book was only to be found in the Bibliotheque Mazarine and St. Genieve, not in the Royal library. It was considered very rare. The book is interesting, as the phrase 'political economy' is first used in it, and its author considered to be the founder. The book is very interesting, praises' and his maxims, and is decidedly strong for prot There are also to be found in it a number

notices. It states that in a room in the large spire of the cathedral of Strassbourg, then belonging to Germany, was preserved the first press, with which Gutenberg had printed his books.

DR. H. A. HAGEN.

Cambridge, Dec. 20.

Reineke Fuchs in political economy.

It is a pity that the recent discussion in *Science* on political economy should end in a kind of mutual triangular contempt. The questions raised are extremely interesting, and especially in the view which Mr. James seemed to take at first; that is, whether we can consider such questions entirely aside from their effect on human character. So far as the principles of political economy are concerned, is it right to lie, cheat, steal, rob, and murder, provided, of course, that one is not caught red-handed. This seems to be the teaching of orthodox political economy, and it is well to state the result plainly. In Goethe's version of the old story, Reineke was successful, and at last became chancellor of the kingdom. But there remain some sentimental people, generally poets, clergymen, and women, who will not believe in Reineke.

ASAPH HALL.

Washington, Dec. 23.

A new meteoric iron from West Virginia.

Through the courtesy of Dr. H. C. Torrey, U.S. assayer in New York, I have come into possession of a mass of meteoric iron weighing about 240 grams, said to have been found near Charleston, Kanawha county, W.Va. It is evidently a fragment from a larger mass, as on no portion of its surface does it present any appearance of the crust invariably forming the exterior of an iron meteorite.

It belongs to the megagramic order of Shepard (the Grobe lamellen of Brezina's new classification), and closely resembles the Sevier county (Tennessee) iron. Its structure is coarsely granular or crystalline, having distinct rhomboidal crystals embedded in the mass. Thin laminae of schreibersite are sparingly distributed throughout, but not in such a manner as to produce the common type of Widmann figures. When a polished surface is etched, it shows a somewhat tessellated arrangement of the figures formed by alternate bands or blocks of kamacite and plessite; but the blocks are irregular in outline, and somewhat wedge-shaped, with rounded sides and angles. Instead of presenting a homogeneous surface, these blocks seem to be cemented together like those of the Arva iron, the distinguishing features of these two falls being confined principally to two points, so far as relates to their general appearance upon an etched surface: viz., the schreibersite shows conspicuously in stone laminae or blocks in the Arva, and only in scattered thin leaves in the West Virginia; and the former is especially subject to oxidation in spots, while the latter seems to be free from them, and it also receives a higher polish, and shows a little lighter color. It was found in 1883, and other pieces are said to exist in Kanawha county. Its time of fall is not known. The British museum possesses a 2,699-gram mass of iron, stated to have been found in Greenbrier county, W.Va., sufficiently contiguous to Kanawha to imply that both irons may have formed part of the same original mass.

In answer to a description of my iron sent to Mr. Davis of the British museum, Mr. D. expressed the opinion that such was the fact, which is confirmed, in my judgment, by his minute description of the museum iron above referred to, which, like my own, is wholly wanting in any thing like a crust. A further comparison with the Sevier county iron shows a like identity in all respects except in the graphitic content, which seems lacking in the West Virginia masses, but altogether so close in appearance and structure as to suggest that both might have come from one original mass. This inquiry must remain a mere suggestion, not fully to be solved even if the separate analyses should closely agree. It is to be hoped for, and yet possible, that fragments may yet be found showing the natural crusted exterior, and that we may learn whether these fragments were all found at one spot, or at such distances apart as to indicate the bursting in mid-air of an iron meteorite, and the scattering of its fragments over an extended line of flight. Of its chemical constitution and the circumstances of its fall, we are quite ignorant.

S. C. H. BAILEY.

Cortland-on-Hudson, N.Y., Dec. 21.

The English sparrow.

Apropos to the discussion on the merits and demerits of the English sparrow pest, it may be interesting to the readers of *Science* to know a little of the way the bird is viewed in England. The London *Academy* says, "It is hard for a lover of birds to approach the 'sparrow question.' Sparrows are found to do more harm than snakes or tigers. Nature's thieves and vagabonds, they are. This is the verdict of every one who investigates the matter. They drive away birds which do more good, and little, if any, harm. For every noxious insect they destroy, they consume more corn than one likes to calculate. A Cheshire farmer, indeed, estimates the loss to England, due to depredations of sparrows, at £770,094 in a year, and this loss is on the increase. No amount of sensationalism can find any countervailing advantage. The careful and long-continued experiments of Colonel Russel in Essex show that sparrows do unmitigated mischief, and the experience of our colonies and of the Americans confirms the facts beyond cavil. There is really nothing to be said for the sparrow. He carries destruction with him wherever he goes, and leaves devastation to mark his increase. From every point of view, he must be looked at as the enemy of man. Either he must give way to us, or we to him; and just now his power is such that he seems in a fair way to become here, as he has already become in Australia, a factor in politics.

"The Colorado beetle can never commit such ravages as the sparrow is certain to do wherever he is allowed to go on unchecked. Love him as we may for his personality, he ought everywhere to be exterminated with the utmost vigor, for there is no limit, in the course of nature, either to his reproductiveness or to the mischief which he causes. We in England have little conception of the scourge he has proved to be wherever he has been naturalized in foreign lands. It is none too soon to have the question put before us clearly, for every day its importance must become greater." There may be some points in this that are overdrawn and exaggerated, but the general tenor of the notes shows that the pest is giving trouble in its native home as well as here.

RALPH S. TARR.

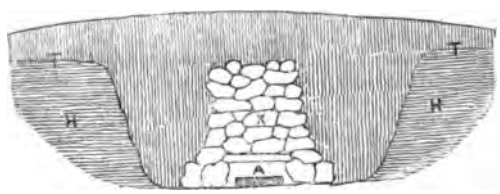
Washington, D.C., Dec. 18.

The Davenport tablet.

As there appears to be a doubt in the minds of many archeologists as to whether these relics should be considered genuine specimens of mound-builders' art, a discussion of their claims to this distinction seems to be demanded.

To do this satisfactorily, a personal inspection of the relics, and a thorough investigation of all the circumstances attending their discovery, should be made. I do not claim to be thus prepared, nor is it my intention to enter at this time upon such discussion; my only object in view in this communication being to call attention to some items in reference to the 'limestone tablet' represented on plate vii., vol. ii., of the Proceedings of the Davenport academy of sciences. The unique and extraordinary character of these relics is calculated, of itself, to raise a doubt in the minds of antiquarians which requires more than ordinary proof of genuineness to render their acceptance as such universal. Examining the excellent albertype of the limestone tablet given on plate vii., vol. ii., of the Proceedings, we are somewhat surprised to see the sun represented with a face; nor is this surprise lessened by finding to the left of the 'hatchet' a regularly formed Arabic 8, made as is customary with writers of the present day, and near the upper right-hand corner the Roman numeral viii. These are not museum marks, as some might suppose, but parts of the original inscription on the stone when found.

The facts regarding the finding, as published by the academy and given by its members, are not calculated to strengthen belief in its genuineness. According to the account given in the Proceedings, (vol. ii. pp. 221–224), the exploration of the mound in which it was found was made by Mr. Gass, assisted by Mr. C. E. Harrison and Mr. John Hume. The account is by Mr. Harrison. The annexed cut is an exact copy of the figure of the mound as given in this account. There was an excavation in the original earth in which was built a pile of stones (x in the figure), over which the mound of earth was thrown. This earth was comparatively loose, "easy to handle, being composed of dark soil with some admixture of clay," and there appeared to have been no indications of stratification. At the bottom of the stone pile was a miniature vault covered by a single flat stone. Lying on the clay bottom of this vault was the tablet, as indicated in the figure. This



vault was about thirteen or fourteen inches square, five inches deep, and, with the exception of the tablet (an inch and a half thick), four arrow-points, a little quartz crystal, and a Unio shell, was empty, as appears from this published account; for it is stated, that, "on raising the flat stone, an irregularly rectangular, engraved tablet *was suddenly exposed to view as it lay face up* in a walled vault, evidently built for its reception" (A in the figure). But in order to be certain as to this inference, I addressed the following inquiry to Mr. W. H. Pratt, the curator of the museum of the academy: "Was the cavity A (fig. 17, *Proc. Dav. acad. sc.*, p. 222, vol. ii) filled with dirt when first observed!" to which he kindly returned this answer: "Mr. C. E. Harrison, who assisted in the work, states that the cavity in which the limestone tablet was found *contained scarcely any dirt* when the flat stone with which it was covered was raised, exposing it to view."

That there should have been an unfilled space in a pile of loose stone in an excavation, beneath a heap of comparatively loose dirt which had stood there for centuries, is certainly most extraordinary.

In a letter now in my possession, written by Mr. A. S. Tiffany in 1882, I find the following statement: "The limestone tablet I am certain is a frand. Mr. Gass was assisted in digging it out by Mr. Harrison and Mr. Hume. Mr. Hume informs me that there was a wall of small bowlders around the tablet. On the tablet there were some arrow-points, a quartz crystal, and a Unio shell filled with red paint, the whole being covered with a rough limestone slab, *the space between it and the tablet not filled with earth, and the paint bright and clean.*" Mr. Tiffany was one of the founders of the academy, and, as appears from the Proceedings, was long one of its most prominent, active, and trusted local members, and is still a member.

If these statements in regard to the conditions under which this tablet was found be correct, — which we have no reason to doubt, as they appear to agree in all essential particulars, — there are strong reasons for suspecting that it was a plant made by some unknown person to deceive the members of the academy. The simple fact that the little vault under the pile of loose stones was empty, save the presence of the relics, appears to absolutely forbid the idea of age. It is well known to all who have taken any part in excavating, that the water, running down through earth and a pile of stones beneath, will at length fill all the crevices with earth, and in fact all places not hermetically sealed.

It is proper to add here that Mr. Tiffany, in the same letter, vouches for the honesty of Mr. Gass (the finder), who, he believes, was deceived. Speaking of the elephant pipe found by Mr. Gass, which he also thinks was a plant, he says, "It bears the same finger-marks as the first one [first pipe], and Mr. Gass could be deceived with that plant as he was with the tablet. Mr Gass is honest." I have Mr. Tiffany's acknowledgment that this letter, which has been in my possession since 1882, is authentic.

Cyrus Thomas.

Disinfection.

In my article on 'Disinfection,' published in *Science* of Oct. 16 (p. 330), under the heading 'Sulphurous acid gas,' the statement is made that this agent 'is important for the destruction of spores.' The reverse of this is true, and the sentence should read '*impotent* for the destruction of spores.' Curiously enough, the same mistake has been made by the printer in my article on 'The destruction of cholera germs,' in Dr. Wendt's recent work on 'Asiatic cholera' (p. 332). Both of these articles were published during my absence in Europe, and I had consequently no opportunity to correct the proof. Unfortunately, the printers have made several other serious errors in the last-mentioned article, the chief of which is the substitution of the word 'grain' for 'gram,' on p. 333.

George M. Sternberg.

Recent Proceedings of Societies.

Naturalists' field-club of Johns Hopkins university, Baltimore.

Nov. 25. — Dr. J. P. McMurrich reported on the work of the zoölogical section. A cruise was made down the harbor, and some interesting marine forms taken by the tow-net, including Evadne, a cladoceran, and a peculiar copepod. —— Mr. W. S. Bailey spoke of the progress made toward completing the geological map of Baltimore, and mentioned the following minerals recently found in the vicinity: malachite and chalcedony (Bare Hills), amethyst (Elysville and Owing's Mills), kyanite and fibrolite in mica schists, on the road between Reisterstown pike and Garrison's lane. —— Mr. F. H. Herrick gave the results of observations made this month (Nov. 14–21) on the vitality of plants as exhibited by their persistence in producing flowers. Within the time mentioned forty-six species of plants were found in flower in the neighborhood of Baltimore. Of these, eighteen belong to the order of Compositae, and twenty, or one-half, are weeds introduced from Europe. The latter were usually the freshest, and produced flowers and fruit in greatest abundance. Of the non-introduced plants, single specimens were commonly found, and those often small or withering. Leaving the latter out of consideration, the late-flowering of the introduced species is readily accounted for. Many of them are perennial in the milder climate of Europe, and consequently, when brought to this country, strive to produce flowers and fruit the year round. Stellaria media, the common chickweed, is a type of this class, and is virtually in flower the whole year. The snow covers in fall its buds and flowers, which expand as soon as the ice melts from around them in spring. This plant was dug from under two feet of snow in mid-winter in Vermont, and, after being placed in water a few hours, its flowers were fully expanded. This explains its phenomenally early appearance in blossom in spring. —— The dispersion of seeds was illustrated by the pods of Cassia nictitans and the 'button-balls' of Platanus occidentalis. The latter tree produces on the average a thousand seeds to each ball, and therefore, in some cases, many millions of seeds; yet it is far from abundant in this and other localities. The oak, which produces relatively so much less seed, is the prevailing tree in this region. The sycamore belongs to an ancient type, the same genus being found among the fossils of the Laramie group. The conditions for its abundant growth are apparently less favorable than formerly. —— Dr. Barton spoke of the bursting of the pods of the Wistaria, comparing the sound produced to a pistol-report.

Calendar of Societies.

Philosophical society, Washington.

Dec. 5. — Annual address by the president, Asaph Hall; subject, American scientific societies.

Dec. 19. — The following officers were elected for 1886: President, J. S. Billings; vice-presidents, William Harkness, Garrick Mallery, C. E. Dutton, J. E. Hilgard; treasurer, Robert Fletcher; secretaries, G. K. Gilbert, Marcus Baker; members at large of the general committee, H. H. Bates, F. W. Clarke, W. H. Dall, J. R. Eastman, Henry Farquhar, G. B. Goode, T. C. Mendenhall, H. M. Paul, C. V. Riley.

Anthropological society, Washington.

Dec. 1. — C. F. Adams, The omitted factor in the promotion of the public good.

Dec. 15. — Discussion on the distribution of wealth.

Biological society, Washington.

Dec. 12. — J. M. Flint, U S.N., Exhibition of representative specimens of Foraminifera from the dredgings of the U.S. fish-commission steamer Albatross; Romyn Hitchcock, The red snow; W. S. Barnard, Digestion, environmental, etc.; C. V. Riley, The mildews of the grape-vine; C. Hart Merriam, Description of a new sub species of the common eastern chipmunk (Tamias striatus).

Engineers' club, Philadelphia.

Dec. 5. — C. W. Buchholz, Engineering, its achievements and its reward.

Connecticut academy of arts and sciences.

Dec. 16. — C. S. Hastings, Some recent determinations of the velocity of light; Leonard Waldo, Description of an electric smelting-furnace.

American academy of arts and sciences, Boston.

Dec. 9. — William A. Rogers and Austin L. McRae, Experiments upon the determination of the temperature of metals as a function of their mass.

Boston society of natural history.

Dec. 2. — Frank H. Cushing, An Indian naturalist, or some Zuñi conceptions of animal and plant life; S. H. Scudder, Some recent important discoveries among the oldest fossil insects.

Dec. 16. — W. O. Crosby, Notes on joint-structure.

Society of arts, Boston.

Dec. 10. — Lieut. F. G. Sprague, Application of an electrical system of propulsion on elevated railroads.

Dec. 23. — Lieut. E. L. Zalinski, U.S.A., The pneumatic dynamite gun, and the use of high explosives in warfare.

Appalachian mountain club, Boston.

Dec. 11. — E. C. Pickering, Geodetic observations from Moosilauke and Mansfield; Alford A. Butler, The Tripyramid slides of 1885; A. L. Goodrich, Notes on the region east of Wild River and south of the Androscoggin.

Society of natural history, Cincinnati.

Dec. 1. — J. Ralston Skinner, Measure of the mound-builders; Joseph F. James, A new species of Gomphoceras from the Trenton group of Wisconsin; A. P. Morgan, The Polyporei of the Miami valley; T. H. Aldrich, Tertiary fossils of Alabama.

Kansas academy of science.

Nov. 10, *annual meeting.* — F. H. Snow, A fossil bird-track in the Dakota sandstone; Robert Hay, A geological section down Fall River; R. J. Brown, Natural gas; F. W. Cragin, A foraminiferous limestone that admits of a polish like marble; The natural history of Barber county; A. H. Thompson, The relation of the state geological survey to the national survey; J. T. Lovewell, Studies on the rainfall of the state, showing no sensible increase;

E. L. Nichols and W. S. Franklin, The destruction of the passivity of iron by magnetic action; Lissajou's figures in three dimensions; B. B. Smyth, Harmonic forms; J. V. Willard and G. H. Failyer, Extraction apparatus to extract fat and similar substances; Sidersky's method of separating calcium from strontium; J. T. Willard, Comparative sweetness of cane sugar and invert sugar: E. H. S. Bailey, Bromide of sodium in the water of an artesian well at Independence: E. C. Franklin and E. H. S. Bailey, Comparative bitterness of different substances; L. E. Sayre, Digestive ferments; D. E. Lautz, Kansas birds; Warren Knaus, Kansas Coleoptera; A beetle that infests and destroys evergreen trees; D. E. Leutz, Great crested fly-catcher and the blue grosbeak; Warren Knaus, Ice-worm; Mrs. N. S. Kedzie, Science in the kitchen; W. A. Kellerman, Methods of collecting and classifying fungi; E. A. Papenoe, Kansas Orthoptera and Hemiptera: J. D. Parker, Wind, temperature, elevation and situation in determining rainfall.

Publications received at Editor's Office, Dec. 14–19.

Abbot, F. E. Scientific theism. Boston, *Little, Brown & Co.*, 1885. 23+219 p. 16°.

Astor, W. W. Valentino: an historical romance of the sixteenth century in Italy. New York, *Scribner*, 1885. 8+325 p. 12°. $2.

Dall, C. H., *Mrs.* What we really know about Shakespeare. Boston, *Roberts*, 1886 [1885]. 204 p 12°. $1.25

Dujardin-Beaumetz, Dr. Les nouvelles médications. Paris, *Doin*, 1886 [1885]. 8+191 p., illustr. 8°. (New York, Christern, $2.)

Gately, C. L., and **Kletzsch**, A. P. Cylinder condensation in steam engines. An experimental investigation. Philadelphia, *Journ. Frank. inst.*, [1885.] 70+2 p., illustr. 8°.

Genth, F. A. Contributions to mineralogy. Philadelphia, *Amer. philos. soc*, 1885. [18] p. 8°.

Genth, F. A., und **Rath**, G. vom. Ueber vanadate und jodsilber von Lake Valley, Sierra county, New Mexiko. Leipzig, *Engelmann*, 1885. [31] p., pl. 8°.

Geography, The eclectic elementary. Cincinnati, *Van Antwerp, Bragg & Co.*, [1885.] 82 p., illustr. 8°.

Marcel, G. Cartographie de la nouvelle France supplément à l'ouvrage de M. Harrisse publié avec des documents inédits. Paris, *Maisonneuve*, 1885. 41 p. 8°. (New York, Christern, $1.)

Marcet, A. Le maroc voyage d'une mission française à la cour du sultan. 2d ed. Paris, *Plon*, 1886 [1885]. 8+298 p., 11 pl. 16°. (New York. Christern, $1.35.)

Memorial technique universel. Paris, *Le Soudier*, [1885.] 421 p., illustr. 48°. (New York. Christern, $2.20.)

Meylert, A. P. Notes on the opium habit. 4th ed. New York, *Putnam*, 1885. 8+49 p. 16°.

Morse, E. S. Japanese homes and their surroundings. Boston, *Ticknor*, 1886 [1885]. 34+372 p., illustr. 8°. $5.

Nourrisson. Tableau des progrès de la pensée humaine depuis Thalès jusqu'a Hegel. 6th ed. Paris, *Perrin*, 1886 [1885]. 8+604 p. 12°. (New York, Christern, $1.35.)

Ratzel, F. Völkerkunde. Vol. 1., lief. 1–10. Leipzig, *Bibliographisches institut*, 1585. 544 p., 10 pl., illustr. 4°. (New York, Westermann.)

Rauchfuss, E. Widerstand und maschinenleistung der dampfschiffe. Kiel, *Lipsius & Tischer*, 1886 [1885]. 60 p., illustr. 8°. (New York, Stechert, $1.50.)

Ray, P. H. Report of the expedition to Point Barrow, Alaska. Washington, *Government*, 1885. 695 p., 20 pl., illustr., map. 4°.

Reclus, E. Pierre Kropotkine. Paroles d'un révolté. Nouvelle éd. Paris, *Marpon*, [1885.] 10+342 p. 16°. (New York, Christern, $1.25.)

Rosny, L. de. Les romains d'orient aperçu de l'ethnographie de la roumanie. Paris, *Maisonneuve*, 1885. 140 p., illustr. 24°. (NewYork, Christern, 50 cents.)

Schmidt, C. The social results of early Christianity. Tr. by Mrs. Thorpe, with essay by R. W. Dale, LL.D. London. *Isbister*, 1885. 32+480 p. 12°. (New York, Scribner & Welford.)

Schwatka, F. Nimrod in the north. New York, *Cassell*, 1885. 8°.

Scudder, N. P. Bulletin of the U. S. national museum. No. 23. Bibliographies of American naturalists.—ii.: The published writings of Isaac Lea, LL.D. Washington, *Government*, 1885. 60+278 p., portr. 8°.

Simon, G.-E. La cité chinoise. Paris, *Nouvelle revue*, 1885. 389 p. 16°. (New York, Christern, $1.25.)

State boards of health, National conference of. Illinois, *State board of health*, 1885. 63 p. 8°.

Sunshine and sea: a yachting visit to the Channel Islands and coast of Brittany. London, *Kegan Paul, Trench & Co.*, 1885. 266 p., illustr 12° (New York, Scribner & Welford.)

Svoboda, A. Kritische geschichte der ideale. Band i.: Der seelenwahn. Leipzig, *Grieben*, 1886 [1885]. 680 p. 8°. (New York, Christern, $4.60.)

Trouessart, E.-L. Les microbes, les ferments, et les moisissures. Paris, *Baillière*, 1886 [1885]. 4+304+32 p., illustr. 8°. (New York, Christern, $2.)

U. S. coast and geodetic survey. Report for 1884. Appendix No. 15. Methods and results, gravity research, use of the noddy for measuring the swaying of a pendulum support. Washington, *Government*, 1885. [8] p. 4°.

—— The same. Appendix No. 16. Methods and results, gravity research, effect of the flexure of a pendulum upon its period of oscillation. Washington, *Government*, 1885. [3] p. 4°.

U. S. department of agriculture. Methods of analysis of commercial fertilizers. Washington. *Government*, 1885. 49 p. 8°.

U. S. geological survey. Bulletin No. 7. A catalogue of geological maps relative to North and South America. By J. and J. B. Marcou. Washington, *Government*, 1884. 184 p. 8°.

—— Bulletin No. 8. On secondary enlargements of mineral fragments in certain rocks. By R. D. Irving and C. R. Van Hise. Washington, *Government*, 1884. 56 p.. 6 pl., illustr. 8°.

—— Bulletin No. 9. A report of work done in the Washington laboratory during the fiscal year 1883–84. By F. W. Clarke and T. M. Chatard. Washington, *Government*, 1884. 40 p. 8°.

—— Bulletin No. 10. On the Cambrian faunas of North America. By C. D. Walcott. Washington, *Government*, 1884. 72 p., 9 pl. 8°.

—— Bulletin No. 11. On the quaternary and recent Mollusca of the Great Basin, with descriptions of new forms. By G. K. Gilbert. Washington, *Government*. 1884. 66 p., 6 pl. 8°.

—— Bulletin No. 12. A crystallographic study of the thinolite of Lake Lahontan. By E. S. Dana. Washington, *Government*, 1884. 34 p., 3 pl. 8°.

—— Bulletin No. 13. Boundaries of the United States and of the several states and territories, with an historical sketch of the territorial changes. By H. Gannett. Washington, *Government*, 1885. 135 p. 8°.

—— Bulletin No. 14. On the physical characteristics of the iron-carburets, etc. By C. Barus and V. Strouhal. Washington, *Government*. 1885. 237+6 p., illustr. 8°.

Vacquant, C., et **Lepinay**, A. M. de. Cours de trigonométrie. Paris, *Masson*, 1886 [1885]. 401 p., illustr. 8°. (New York, Christern, $1.65.)

Vambery, A. Arminius Vambéry, his life and adventures. London, *Unwin*, 1886 [1885]. 20+350 p., illustr. 12°. (New York, Scribner & Welford.)

Vincent, H. Mrs. Forty thousand miles over land and water. The journal of a tour through the British empire and America. Vols. i. and ii. London, *Sampson Low*, 1885. 292, 266+32 p., illustr. 12°. (New York, Scribner & Welford.)

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SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 25, 1885.

THE CANADIAN PLAINS.

THE name Qu'Appelle, given to the river, charming valley, and village in eastern Assiniboia, long ago settled by half-breeds, and now one of the most productive districts in the north-west, is literally 'Who calls?' It is French for an old Cree appellation, *Kateépwa*, referring to the curious calling or talking noises heard there in winter from beneath the ice. These sounds are most noticeable among the deep coulées near Fort Qu'Appelle, some fifteen miles north of the railway station. The Crees had a separate name, however, for the locality of the Hudson Bay company's trading fort, *Kipáyikinik*, meaning 'closed gates,' and referring to an aboriginal fish-dam at that point. The word 'Manitoba' (which is *not* pronounced Manitobá) signifies 'spirit voices,' and was given to the lake by the Indians on account of the remarkable susceptibility to echoes possessed by the flinty cliffs of its largest island, an echo to all aboriginal minds being the mocking answer of some mischievous spirit.

Just west of Moose Jaw we rise to the top of that great steppe called the Grand Coteau du Missouri, which abruptly separates the drainage of that river from the Saskatchewan's. It is a dry plain, resembling more that of Dakota than any thing seen farther east. It is probably true, as has often been explained, that the reason why the whole valleys of the Assiniboine, Qu'Appelle, and lower Saskatchewan, are not covered with trees, is, that they were annually burned over by the Indians in signalling to one another, or as an aid in guiding and chasing the buffalo. With the extinction of the bison, and the consequent disappearance or concentration of the nomads, forests would re-assert their sway were it not for the new interference of white settlement.

Upon these more arid uplands, tree-growth is not to be expected, and seems never to have existed. Yet they are by no means as dry, nor as barren, as those within the United States. Agriculture succeeds without irrigation all the way between Moose Jaw and the foot of the Rockies, though only a few years ago that area was termed a desert. The one drawback is early frost; but the people are learning how to diminish within a practicable limit the danger from this source. Grant's article in the *Century* for October, 1885, though as a whole inadequate and unsatisfactory, discusses this point pretty well, and shows (what my own later observation bore out) that the railway company's experimental farms produced bountiful crops at intervals all the way from the beginning of the Coteau to the crossing of the South Saskatchewan. The geology of these uplands, and other physical characteristics, are well presented by Dawson, Hind, and other explorers, whose reports have been printed by the Canadian or English governments. Our Pacific railroad reports hold much information and many pictures as to the Coteau, which is not without its beauty.

The characteristic feature in the scenery which constantly interrupts the monotony, and marks another distinction from the 'American' plains, is the great number of lakes. They begin, as seen from the cars, with the Old Wives' lakes,—extensive bodies of water, into which flow several considerable streams from the Cypress Hills, but which have no outlet. These lakes, like most of those which succeed them, are saline. The people there will tell you that this is due to the potash washed into them after prairie fires. It would be easy to argue this out of existence, and show that their salts are sulphates of sodium and magnesium, together with certain chlorides, dissolved out of the marly, cretaceous soil. In many of the smaller lakes the efflorescence of these salts forms a snowy beach, upon which the waters, blue as the sky (or perhaps pale green when the reflection of the azure sky mingles with the yellow bottom shining through), break with a constantly refreshing ripple; and this glittering strand is itself rimmed by a line of richly red samphire, outlined with the vivid emerald of grasses kept fresh by the moisture for a narrow space between the water and the gray plain. Sometimes, late in summer, the salty ponds will partly dry, leaving muddy flats exposed, where a close brilliant carpet of ripe samphire, maroon in color, will overspread the whitened mud; while, in cases where the alkali is excessive, no samphire grows, but the drying-up of the lakelet leaves a wide area of gleaming salt, looking precisely like ice or crusted snow.

The larger ponds are frequented by hosts of herons, gulls, and white pelicans. I have no doubt the last named breed there. The great expanse of sedges, growing in fetid sulphurous mud around its borders, gave the name Rush Lake to one of the largest ponds seen; but this is very unusual,

and due probably to the comparative freshness of the water. I found Limnea campestris, Planorbis trivolvis, a small Gyraulus, and a Physa, on its banks during the halt of the train. Physa does not object to strongly alkaline waters, or to springs of a high temperature, and probably occurs in most of the alkali ponds. Ducks are not common even in the migrating seasons, though one small water-fowl, which seemed to be a grebe, abounded on nearly all the lakes.

The birds of this region have been pretty thoroughly collected by Professor McCoun, who, more than any other naturalist, has travelled over these north-western plains. He made this year a list of no less than 110 species of birds during a rather limited search for alpine plants between Calgary and the Selkirks.

The railway, after crossing the South Saskatchewan, in lat. 50° at Medicine Hat, on a beautiful iron truss bridge built in Pittsburgh, takes a northerly course until it reaches the 51st parallel at Calgary. This is on the outermost edge of the foot-hills of the Rockies, which first come into view at Gleichen, 100 miles away. This was neutral ground between the Plains, Crees, and the Blackfeet; the former wandering northward, and the latter occupying the Cypress Hills and the plains between Bow River and the country of the Bloods and Piegans along the U.S. boundary. On the lower Bow River were located a section of the Blackfoot nation, named Sarcees. The site of Gleichen was known to the trappers in the long-long-ago of the last decade as Blackfoot Crossing. Since then the Bow was easily fordable. Thirty-five miles northward, where the Rosebuds flow into Red Deer River, are the Hand Hills, having bluff faces southward forming the 'Cree look-out.' The Blackfeet, going north in pursuit of buffalo, would be sighted by sentinels posted here, and instantly chased, whereupon a race would ensue back to the Crossing. There may still be discovered remains of intrenchments thrown up by hard-pressed Blackfeet as a defence in fighting off their pursuers until they could get to the safe side of the ford. This borderland of constant struggle ought to yield a rich harvest to the archeologist. How Putnam or Abbott would enjoy following the first plough!

I was told in regard to these Indians (who look and dress precisely like those in Dakota and Montana) something which was new to me; namely, that originally (not through white teaching) they kept a regular police patrol in their villages all night. This consisted of a few young men appointed daily by the chief, whose business it was to see that no one left or entered the village after bed-time without a thorough explanation, and to prevent skylarking or mischief of any kind. This was not a herd-guard or military precaution, but a civil police.

Calgary is advantageously placed at the junction of the Bow and Elbow, — names given by the Indians. It stands upon a gravelly plateau, with no trees in sight save the cottonwoods in the river-bottoms, and with the mountains grandly in view. It is the site of quite a modern post of the Hudson Bay company, which has now abandoned its stockade for a commodious store in town, and it is the headquarters garrison of the mounted police. The horse-training evolutions of this irregular cavalry are very interesting; and one hears remarkable stories of the fidelity and intelligence displayed by these animals during the arduous campaigns, often in the depth of winter, which they often share with their riders. Many a half-frozen trooper's life has been saved by the kindness and courage of his horse. Calgary is a large and growing town.

The winters here are, of course, very severe; the mercury often sinking to — 40° F., and staying below — 20° for weeks together. No one complains, however, except when the wind blows; yet harrowing tales of suffering and death are heard, where men have been caught at some disadvantage. The snow in the foot-hills lies deep, but on the plains disappears rapidly under the influence of the warm, dry wind sweeping up from the great Utah and Columbia basins, which people here erroneously call the Chinook. Cattle feed out all winter among the rolling, partly wood ridges about Fort McCleod, — perhaps the best cattle-region on the continent; but in the neighborhood of Calgary winter feeding is necessary, and as far north as the Red Deer River (a fine summer range) cattle-ranching is considered impracticable on account of the depth of snow. Between Calgary and Fort McCleod the foot-hills are devoted to sheep. ERNEST INGERSOLL.

CARBOLIC ACID AS A DISINFECTANT.

OF all popular ideas, none seems to be more firmly rooted in the public mind than the notion that carbolic acid is a disinfectant of the most powerful nature. When a disinfectant is wanted, people go to a druggist for some preparation of carbolic acid, and he gives them 'carbol,' or 'carboline,' or 'carbolcine,' or 'carbolic purifying powder,' or some similar thing, which is warranted to be 'the best disinfectant known,' and 'a sure preventive against small-pox, measles, cholera, mumps, diphtheria, whooping-cough,' etc. Then the buyer goes home, sprinkles his carbolic-

acid preparations round, smells a strong smell, and feels safe.

This notion probably arose from the fact that carbolic acid is a very good deodorizer and a very good antiseptic, and that the popular mind has failed to distinguish between these properties and those of a disinfectant. Indeed, it may be said that the scientific mind made the same mistake until the ubiquitous germ theory made its appearance to explain, among other things, just what a disinfectant was. A disinfectant must, according to this theory, be a germicide; and, if it is to be of any use, it must kill the germs quickly, and when used in comparatively small quantities. The question before us is to decide how far carbolic acid fulfils this indication. The first experiments[1] made with a view to answering this question were those of Rosenbach,[2] who, in 1873, showed by experiments on unhealthy pus that a 0.5-per-cent solution of carbolic acid did not act on this substance as a disinfectant, but that a 5-per-cent solution did. About the same time Devaine[3] proved that a 0.5-per-cent solution had no effect on the anthrax bacillus. Similar experiments by Braidwood and Vacher,[4] and Dougall,[5] seem to show conclusively that vaccine virus is not changed when subjected to the prolonged action of a 1-per-cent solution of carbolic acid, and that in some cases it was not affected by a 2-per-cent solution. Sternberg[6] has also shown that nothing less than an 0.8-per-cent could be relied on to destroy the micrococci of pus and septicaemia.

The latest researches on this subject are those of Gärtner and Plagge.[7] These gentlemen, under the supervision of Koch, carried on a careful and elaborate series of experiments on thirteen different species of micrococci, using solutions of 1 per cent, 2 per cent, and 3 per cent. One part of pure culture was shaken up with forty-nine parts of the carbolic-acid solution, and allowed to stand for a longer or shorter time.[8] Then a small portion of the mixture was placed in conditions favorable to growth. It was found that under these circumstances the 1-per-cent solution did not act at all as a germicide, that the 2-per-cent solution failed to kill the germs in two out of the thirteen cases, and that the 3-per-cent solution acted in all cases as a disinfectant. A further series of experiments showed that a 3-per-cent solution of carbolic acid would probably act as an efficient disinfectant when applied to the hands, to surgical instruments, to dressings, etc.

Earlier experiments[1] by the same authors, as well as some of Braidwood and Vacher's experiments, showed that in a gaseous state about 12.5 grams per cubic metre would be needed to disinfect damp clothing, and 15 grams per cubic metre to disinfect dry clothing.

In view of these experiments, it seems very clear that carbolic acid is of no value whatever when used in any ordinary quantities to disinfect sick-rooms, water-closets, clothing, etc., and is of doubtful utility in any case unless the object to be disinfected can be thoroughly soaked in a solution at least as strong as 3 per cent.

F. S. BUNKER.

[1] An exhaustive *résumé* of the literature on this subject is to be found in the *Medical news*, xlvi. 317–320.

[2] *Med. record*, viii. 427.

[3] *Comptes rendus*, lxxvii. 821–825.

[4] *Brit. med. assoc.*, Scientific reports, London, 1876.

[5] *Brit. med. journ.*, 1879, ii. 726–728.

[6] *Amer. journ. med. sc.*, lxxxv. 321–344.

[7] *Archiv. klin. chir., Berlin*, xxxii. 403–413.

[8] In the different series of experiments the times were 8, 15, 30, 45 seconds, and 1, 3, and 5 minutes.

MALTHUS AND HIS WORK.

Two recent productions have come to our notice, having for their chief subject the Malthusian theory of population. Mr. Bonar's book[2] contains a painstaking and intelligent account of Malthus' 'Essay on the principle of population,' and the discussions which preceded and followed it; an impartial review of his other writings and controversies; and a brief narrative of his personal life. Mr. Nossig's series of papers[3] presents a pretentious medley of learning unaccompanied by insight, of that arrogance towards old wisdom which a superficial acquaintance with modern knowledge often induces in a shallow mind, and of that amusing species of childishness which manifests itself in writing down formulas having a profoundly mathematical appearance to express obvious truisms or crude scientific fancies.

One cannot help feeling, on reading an article like Nossig's, — written by an educated man, and published in a scientific journal of high standing, — that the way in which the doctrine of Malthus has fared with a considerable part of the reading and writing world is most discreditable to the average human mind. That a doctrine pregnant with the weightiest practical consequences in human affairs should for a century be disputed in every way, — with wisdom and with folly, with logic and with sophistry, by fair means and foul, — is not surprising; but that its opponents should still so often fail to grasp the meaning of the doctrine itself is

[1] Deutsch. verein für oeffentliche gesundh. pflege.

[2] *Malthus and his work*. By JAMES BONAR. London, *Macmillan*, 1885. 8°. (New York, Harper.)

[3] *Ueber die Sterblichkeit*. By ALFRED NOSSIG. *Konitz*, 1885.

discouraging and humiliating to any one who has high hopes of the intellectual development of mankind.

Mr. Bonar's book will, it is to be hoped, tend to remove one of the causes of this persistent failure to understand Malthus, which, it is charitable to suppose, has been operative in the case of Mr. Nossig, as it has been in that of better men. The simple task of reading what Malthus wrote is one which his critics have frequently omitted to perform. Mr. Bonar adduces the striking instance of no less a man than Nassau William Senior, who "confessed with penitence that he had trusted more to his ears than to his eyes for a knowledge of Malthusian doctrine, and had written a learned criticism, not of the opinion of Mr. Malthus, but of that which 'the multitudes who have followed, and the few who have endeavored to oppose,' Mr. Malthus assumed to be his opinion." Now, Mr. Bonar's book may be expected to have, in two ways, some effect in removing this kind of ignorance: for, on the one hand, he gives a sufficiently full account, not only of Malthus' theory, but of his book, to show that Malthus had considered the subject from every point of view, and had collected and discussed with pre-eminent sagacity a large array of facts affecting and affected by his doctrine of population; and, on the other hand, his account of the history of the book and its author is calculated to awaken sufficient interest to lead many to read Malthus himself.

A few specimens of Mr. Nossig's work will serve to illustrate its character. "The methods and the economic stand-point of Malthus may be recognized from the way in which he groups the subjects of his investigation. On the one side he places man and his tendency to multiply; on the other, the earth and its productivity. These ideas he isolates, *without recognizing a reciprocal influence between man and the soil.*" It would not be a gross exaggeration to say that there is scarcely a page of Malthus in which this reciprocal influence is not recognized. Malthus continually considers the power of agricultural and social improvement to increase the productivity of a given territory; but he continually insists that it is impossible for this power to keep pace for a long period with the increase of population, which would result from a state of general comfort, without the presence on a large scale of preventive or destructive checks.

Nossig goes on to say that it was in this way easy for Malthus to deduce that "simple mathematical scheme which, among others of his followers, John Stuart Mill accepted. This distinguished thinker, however, who so clearly expounded the difference between the various methods of sociological investigation, . . . overlooked (*hatte übersehen!!*) the fact that his master based his whole theory upon the erroneous geometrical method." The idea of Mill's 'overlooking' the fact that the Malthusian theory, which he accepted, was based upon a method he condemned, is ridiculous. The notion that it *was* based upon the 'geometrical method' has no logical foundation whatever, and has for its sole apparent origin the fact — an unfortunate one, as Malthusians in general will admit — that Malthus gave a conspicuous place in his exposition to a mathematical expression which was intended rather to facilitate the comprehension of the effects with which he was dealing than to convey any thing like an exact statement of the phenomena. But taking the matter at its worst, and supposing (what is thoroughly false) that the contrast of the geometrical increase of population with the arithmetical increase of food were an essential part of the Malthusian doctrine, there is not the faintest trace of the 'geometrical method' in the mode by which Malthus arrived at it. He deduced his law of population from observation of man and the world.

Mr. Nossig finds it no harder to explain Darwin's than Mill's acceptance of Malthus' views: "Darwin was no sociologist, and in the theory of Malthus he saw only a detached item (*moment*) of actual natural relations; hence he accepted it." Space will not permit us to show how Mr. Nossig misapprehends Darwin's own doctrines, and misapplies his misapprehensions to Malthus: but the reader will probably absolve us from the duty of detailed criticism of a writer who thinks he is saying something relevant to the Malthusian problem when he cites the fact that while in two years a human pair can at most double their numbers, a grain of wheat can in the same time be increased a thousand-fold, and thereupon inquires, "Does there, then, actually exist in nature the tendency to make the products which serve for the nourishment of human organisms multiply less rapidly than these organisms?" But if any one thinks that the commission of this favorite *bêtise* of anti-Malthusians is in some way pardonable, he may perhaps find himself able to determine the genus of writers to which Mr. Nossig belongs by the following passage in the constructive portion of his production. In the formulas E denotes the 'evolution' of the human society in question, g denotes the social force of gravitation (or conservatism), and T the force which is 'represented by the struggle for existence:'

"We know that $E = f(T, g)$. Now, T is a function of the reproductive force R, which function we shall express by ϕ, so $T = \phi(R)$: hence $E =$

$f[\phi(R), g]$. Hence it follows that the evolution itself is a function (F) of the reproductive force and the social force of gravitation, $E = F(R, g)$. In consequence of this we may say, conversely, $R = \Psi(E, g)$, where Ψ expresses the function represented by R." The last of these equations is marked III, being the third and last of the great formulas arrived at by Mr. Nossig.

We cannot take leave of Mr. Nossig without an apology to our readers for having given him so much space; but our defence is twofold. In the first place, it seemed worth while to stigmatize even so worthless a production when it had been accorded forty pages of space in *Kosmos;* and, secondly, although Nossig's childish endeavors at theory-making serve to expose his incapacity for scientific thought, his criticisms are not unfair specimens of a large part of anti-Malthus literature.

In speaking of Mr. Bonar's book there is less occasion for criticism than for description. It is not intended as an original contribution to the discussion, but as an account of the discussion as it has actually taken place; though, to be sure, there are not wanting passages in which the author gives his own judgment upon the merits of rival arguments. He narrates how Malthus' first essay on population arose out of debates between Malthus and his father on the opinions of William Godwin, and shows how the impression produced by this first essay decided the bent of its author's life, and how the second essay, published five years later (in 1803), differed from the first through being the embodiment of extensive personal observation as well as reading and reflection. This is followed by a detailed account of the larger essay, so far as it relates immediately to the question of population in a narrow sense; and after this we have a summary of Malthus' views on the greatest economic questions, not only as they appeared in his great essay, but also as he presented them in his other works. We shall not attempt to give a summary of a summary, but it may be worth while to direct attention to one or two points which will perhaps be surprising to those who fancy that humanity and moderation are a new thing in political economists. To such men it may sound strange to hear that "to Malthus the discovery of truth was less important than the improvement of society. When an economical truth could not be made a means of improvement, he seems to have lost interest in it." Nor will they be less surprised to learn that he had "the virtue of refusing to join the economical Pharisees, who would not admit the elasticity of economic laws, lest they should discredit their science." And though it is the followers of Ricardo whom Mr. Bonar here designates as the economical Pharisees, one may profitably ponder the words which Mr. Bonar quotes from a letter written by Ricardo to Malthus: "Our differences may, in some respects, I think, be ascribed to your considering my book as more practical than I intended it to be. My object was to elucidate principles; and to do this I imagined strong cases, that I might show the operation of these principles." The misfortune of the matter is not that the critics, but that the followers, of Ricardo imagined his book to be 'more practical than he intended;' and thus it has happened that economists of the present generation, finding as the most conspicuous effect of Ricardian teaching the prevalence of certain practical dogmas, have thought that in exposing the untenableness of these dogmas they were overthrowing the scientific method on which the theory of political economy had been built up.

The last three chapters of Mr. Bonar's book are devoted respectively to Malthus' views in moral and political philosophy, to 'the critics,' and to the biography of Malthus. The chapter on the critics is one of the most interesting in the book. The whole work shows evidence of the most minute and painstaking study: in fact, it would, we are convinced, have been decidedly more useful had the author not been quite so well informed as to the exact changes made in successive editions, and had he omitted many details which were necessary in the time of Malthus, but which are without interest now. The book might, without loss, have been greatly abridged; and, as the main service it will render is to make Malthus more readily accessible, this would have been an important improvement.

THE FORMS OF SHIPS FOR WAR AND FOR PEACE.

AMONG a collection of very valuable papers recently published by the British institution of civil engineers, is a report of a lecture of exceptional value by the great naval architect, Sir Edward J. Reed. The address was a short one, but very comprehensive. The speaker begins by comparing the conditions affecting the long and the short ship of equal weight-carrying power, showing that the character of the work for which the vessel is intended, and even the nature of the material of which its hull is composed, are circumstances affecting the form of maximum efficiency. The long ship of small wave-making action, but of great friction-producing power, is shown to be best for the case of light hull and heavy loading: the short, broad vessel, on the

other hand, is best for the case of the heavily plated, lightly loaded ship. The heavier the armor, the shorter and broader, proportionately, must be the hull chosen to do the best work. The fact that the shorter and broader, though for a given displacement the lighter, ship demands greater engine-power, brings another complication into the problem; and it is for the naval architect and engineer to seek the form which, on the whole, will be best for his purpose. On the whole, it is found that, for war-vessels, the heavier the armor to be carried, the fuller the form to be chosen: in other words, the value of a ship for purposes of war is not to be judged at all by the magnitude of the so-called 'constant of performance' (cube of the speed, multiplied by the two-thirds power of the displacement, divided by the indicated horse-power). A ship with a high coefficient may be a very bad vessel for war purposes, even though easily propelled through the water. This is a very important principle in naval architecture, and is the more to be kept in view from the fact that it has been customary for many years to judge the value of a design by the magnitude of this constant or some similar quantity. The application of a correct method of comparison shows the Belerophon, a short ship of 300 feet length, to be superior as a war-vessel to the Minotaur, — a ship of 400 feet length, and of much finer form. The smaller ship was 'handier,' attained the same speed, carried an equal battery better protected, had the same engine-power, and cost less than three-quarters as much as the larger. But her coefficient was about 15 per cent lower. This comparison effected a revolution in the naval design of Great Britain. The later iron-clads are built with a length only about five times the breadth, though steaming 16 and 17 knots.

It is found, on carrying out the investigation, that the short, broad ship, which should be given, nevertheless, fine 'entrance' and 'run,' may often be subject to less resistance than a rival craft of greater length and less beam. This was shown by Froude's experiments on the Ajax and a rival form. The magnitude and position of the 'bow wave' relative to the stern of the ship is one of the important modifying conditions. Should that wave take the right position, the resistance may be much less than where it comes in the wrong place. The action of the screw, in relieving the pressure of the water under the stern, is another serious consideration. Froude found, that, if it could be placed one-fourth or one-third the ship's beam from the stern of the vessel, the resistance to propulsion would be very much decreased. The introduction of a lengthened middle body may or may not aid; but no principle or formula has yet been found to determine what the effect will be.

Of the three principal elements of resistance, the friction of the skin of the ship, the wave-making effect, the eddy resistance, the first is usually the greatest. In very fast vessels the second and third may approximate to equality with the first. At low speeds the friction may be nine-tenths the total: at high speeds, such as now are becoming common, the frictional resistance may become as low as one-half the total. Comparing war-vessels, it is seen that fine-lined ships having thick armor would require to be of enormous length, size, cost, and power, while the same offensive and defensive power may be obtained in full-lined ships at much less sacrifice of all desirable qualities.

No insuperable obstacles exist to-day to the production of armored war-vessels capable of defying all the ordnance of the world, and of carrying their own armament at a speed of 18 or 20 knots into the waters of any enemy. The cost of such vessels has become so great, however, that progress in this direction has apparently nearly or quite ceased for the present. The engineer and naval architect is prepared to do his part of the work whenever the nation shall call upon him.

This was the closing lecture of a course covering the general subject of hydromechanics, and was considered a very fitting final address.

MEDICAL MISSIONARY WORK IN CHINA.

In 1881 Dr. Elizabeth Reifsnyder graduated in medicine from the Woman's medical college of Pennsylvania. Two years afterward she went as a medical missionary to Shanghai, where she is in charge of a new and handsome hospital. On Oct. 25, 1884, she performed the first ovariotomy ever done in northern China. The subject was thirty-one years of age, and travelled about five hundred miles to see Dr. Reifsnyder. The tumor weighed thirty-three pounds, and eleven days after the operation the patient sat up.

A successful operation like this soon made her famous, and the Chinese published accounts of the case. From one of these pamphlets the annexed cut is reproduced. It is evidently an ideal sketch by a native artist of great capacity, and vies in its amusing misrepresentation with some of the manufactured conversations of the modern interviewer.

It is *al fresco;* and evidently two passers-by — an Englishman and a Scotchman, to judge their looks — have been attracted by the s are watching it from the street. B attitude and dress are the most an

the 'composition,' as it may well be called. She is kneeling with one knee on the patient's knees; and her Derby hat, French shoes, train dress, and extraordinary coiffure and earrings would proclaim her rather a devotee of fashion than of science. The assistant, whose left arm is apparently dislocated, and the cheering relics of former patients displayed on the top shelf of the showcase, complete a picture that is unique in medical illustrations, so far as we are familiar with them.

Dr. Mildred M. Philips, in a communication to the Alumnae association of the college, gives a translation of the character seen in the cut, a part of which is as follows: —

"A knowledge of the *Rhyming medical adviser* is considered a sufficient qualification to be a practising physician. Such ignoramuses [as those thus qualified] recklessly prescribe for disease, and ignorantly trifle with men's lives. If a patient dies, it is charged to his fate, and the doctor is not held responsible by the law. If a patient survives, he praises the skill of the doctor."

The article in the pamphlet from which the cut is taken gives a short account of the operation, and then adds, "If this disease had not met with this doctor, it could hardly have been relieved. If this doctor had not met with this disease, who could have known any thing of such divine skill?

"When Chinese doctors hear of this, their tongues will become immovable, and their heads will hang down."

DOCTORS AND THEIR WORK.

ENGLISH medical annals contain many names both familiar and honored the world over. It has not been a difficult matter, therefore, for Mr. Bettany to prepare a fair history[1] of the progress of medical science in England during the past three hundred years. Beginning with Harvey and Sydenham, and ending with Sir James Paget and Sir Joseph Lister, the author has sketched the lives of a succession of scientific men, eminent in the various departments of medicine and surgery, of whom any country may well be proud. It is, perhaps, from such memoirs as these that the history of progress in medicine can be most pleasantly traced. The personal element in science is often neglected, but always repays investigation. And nothing is more entertaining than to notice how the pure scientific spirit in search of facts

[1] *Eminent doctors. Their lives and their work.* By G. London, *Hogg*, 1885. 8°.

displayed by one, the clear reasoning powers of another, and the practical mind of a third, all have their place, and combine to produce a result which no one genius alone could have reached. Harvey and Hunter may be selected as types of the first class mentioned, as they were among the earliest to make evident the necessity of an accurate knowledge of the structure of the body as a foundation for all further progress. In the museum which bears Hunter's name is to be found a lasting monument of his influence in impressing upon his contemporaries and successors the need of a wide collection of data for scientific induction. With him may be classed Charles Bell and Marshall Hall, whose careful physiological experiments furnished many of the facts upon which modern theories are based. The reasoning mind which advances from facts to conclusions is exemplified by such men as Bright and Addison and Holland. To put facts together, to balance their comparative importance, to eliminate the non-essential, and thus to reach a logical conclusion, is the work of the diagnostician, — a work which may not bring lasting fame, since it is concerned with individual cases only, but which is none the less important in increasing the sum of general knowledge. It is, perhaps, in the practical application of facts and theories that the English school has been pre-eminent. The names of Astley Cooper, Syme, Jenner, and Lister, will occur naturally in this connection. To Jenner and Lister the race owes a tremendous debt. They have saved, and are to-day saving, the lives of thousands. And it is not only for the methods of vaccination and antiseptic surgery that science is indebted to them: it is for the principle involved in these methods, — the principle of preventive medicine. To cure an individual case may be gratifying, to discover a remedy for a single disease may be beneficial; but to find a means of making the entire race exempt from certain dangerous affections is indeed a triumph. Under Lister's method of antiseptic surgery, operations are daily performed which the boldest of all the surgeons in this list of eminent men would never have ventured to undertake. The history of Lister's discovery is interesting. In 1860 he was put in charge of a new hospital in Glasgow, and, although the most approved principles were employed in its construction, it proved extremely unhealthy. Pyaemia, erysipelas, and hospital gangrene showed themselves, affecting most severely those patients in the wards nearest the ground. Lister noticed, that, when nearly all the beds contained patients with open sores, the diseases which result from hospital atmosphere were sure to be present in an aggravated form; whereas, when a large proportion of the cases had no external wound, these evils were greatly mitigated or entirely absent. He had also been struck with an account of the remarkable effects produced by carbolic acid upon the sewage of the town of Carlisle; the admixture of a very small proportion not only preventing all odor from the lands irrigated with the refuse material, but also destroying the entozoa which usually infest cattle fed upon such pastures. These facts, taken in connection with others which he had ascertained in experiments concerned in proving the germ theory of disease of Pasteur, led him to the idea that if a wound could be closed to the entrance of air, or be kept from all obnoxious influences in the air by the use of carbolic acid, the conditions for rapid healing without the complication of hospital diseases might be fulfilled. From this idea was developed the entire system of antiseptic dressings which bears the name of Lister. From the first experiments in the use of these dressings, a change in surgical procedure began; and now, under their use, wounds which never healed formerly under three or four weeks, are completely healed in six days. Operations which were followed by days of fever and distress are now succeeded by rapid recovery without any surgical fever. Various procedures are daily undertaken which formerly would have been unhesitatingly declared impossible, and pyaemia and hospital gangrene have been almost banished from wards where the system is properly carried out (ii. 141–147).

It would have added to the interest of this book if a large number of details had been given regarding the personal characteristics of the physicians whose lives are sketched. Even without these, however, the book will prove of interest both to those in the medical profession who wish to know something of their English predecessors and contemporaries, and to those outside of the profession who are interested in the history of the progress of science. M. A. S.

Dr. A. B. Griffiths, of the Manchester technical school, has published the following account of an assay of gold ore from the vicinity of Constantinople: "The gold is disseminated in very small pieces here and there through a quartz and earthy matrix. The ore comes from mines which have not been worked for several centuries, and were thought to be exhausted of gold. The assay, both by dry and wet methods (of a carefully selected sample), gave 3 oz. 14 dwt. of gold per ton of ore. The gold in the ore contains iron and copper, and a very small quantity of silver. The matrix is composed chiefly of quartz, but contains calcic carbonate, ferric oxide, alumina, and lime."

INDEX TO VOLUME VI.

*** *Names of contributors are printed in small capitals.*

ABBOTT, C. C. Aestivation of mammals; what is it? 402.
Abbott, Miss H. C. D., on Yucca angustifolia, 210.
Abert's squirrel, 82.
Abnormal black bass, *ill.* 243.
Actinometer, self-recording, 313.
Adelaide observatory, 350.
Aden, tornado at, 58.
Adulteration of honey, 210.
Aepyornis, 418.
Aerial navigation, 20.
Aerostatic school, 300.
Aestivation of mammals, 402.
Afghan boundary, tribes upon, *ill.* 69.
Africa, around, *ill.* 114; coal-beds in, 59; cultivation in, 160; East, explorations in, 311; German possessions in, 40; West, Cameroons district, 555.
African expedition, 60; islands, 306; slave trade, 441; smithy, *ill.* 347.
AGASSIZ, A. The coast survey and 'political scientists,' 253.
Agassiz, A., 302.
Agassiz's Life of L. Agassiz, reviewed, *portrait*, 330.
Agassiz, L., on the activity of the mind during sleep, 244; influence on scientific activity, 384; life of, *portrait*, 330; memorial of, 258.
Agassiz museum, *ill.* 421.
Agricultural chemists, meeting of, 248; convention, 68; science, society for promotion of, 2, 193.
Agriculture, demands of, on botany, 193; university courses in, 240.
Alabama weather-signals, *ill.* 181.
Alaska, exploration of, 278, 357, 380, 448; industries of, 357, 427; late news from, 95; native tribes of, 228; whaling catch in, 259.
Alasoniere's Horse breeding, reviewed, 447.
Albatross, last cruise of, 110.
Alert expedition, 350.
Algeria, colonization in, 317.
Allen's exploration of the Atnah River, 357, 380.
Allen's Organic analysis, reviewed, 356.
Alloys, aluminum, 210; copper and silver, 231.
Almucantar, 406; observations, 206, 239.
Alpine cretinism, 484.
Alps, Austrian, temperature in, 459.
Aluminum alloys, 210.
Alvord, H. E., on human foods, 235; telemetric aid to meteorological records, 194.
America, ethnography of antarctic, 92.
American association for the advancement of science, 197, 201; committee reports, 202; composite portrait of officers of, *ill.* 167; local committee, 116; officers elect, 238; proceedings of sections, 204, 206, 210, 214, 219, 224, 227, 230, 235; resolutions concerning coast-survey, 204; publications of, 141; astronomical society, 312; contribution to museum economy, 82; economic association, 239, 464; flash language, 283; forestry congress, 181, 312; historical association, 249; history, materials for, in foreign archives, 250; opticians, honor to, 306; public health association, 428, 441, 449, 453, 511, 531; Silurian scorpion, *ill.* 87, *ill.* 183, 184; society of civil engineers at Deer Park, 13; for psychical research, censorship of, 81; first report of, reviewed, 155.
Americanists, international congress of, 240.
Amherst college science association, 100.
Amia, serrated appendages of, 226.
Amphipleura pellucida, photographs of, 228.
Anaesthetic, chloroform as, 154.
Analysis, statistical, 237.
Andromeda, new star in nebula of, 247, 310, 359, 473; spectrum of, *ill.* 262, 333, 336.
ANGELL, J. B. A need for a careful study of the history of China, 479.
Anglo-Saxon, history of, 487.
Ann Arbor, American association at, 197, 201; undergraduate study at, 428.
Annisquam zoölogical station, 259.
Anthrax inoculation, 120.
Anthropological school of Paris, 476; section of American association, 230.
Anthropologists, congress of German, 475.
Anthropology, criminal, 238.
Anthropometric apparatus, 361; instructions, 476.
Antisell, T., on laboratory practice, 211.
Appalachian mountain club, 428.
Archeological discovery, 19.
Archeologist in trouble, 386.
Archaeopteryx, 116.
Arctic coast of Alaska, 381.
Arctic exploration, 349.
Arethusa, cruise of, 384.
Argentine republic, boundary of, 426; colonization in, 555; trade routes with Bolivia, 555.
Arizona natural bridge, *ill.* 67; scenery, 44.
Armsby, H. P., on Cooley system of creaming milk, 194.
Arthur, J. C., on pear-blight, 225.
ASHBURNER, C. A. The geology of natural gas, 42, 184.
Asia, central, explorations in, 554; maps of, 451.
Askabad, mineral resources of, 359.
Association of official agricultural chemists, 248.
Associations, color, 82, 125, *ill.* 142, 186, *ill.* 242, 337.
Asteroid, new, 333, 406, 449.
Asthma, 396.
Astronomical day, 18, 358, 444; notes, 95, 310, 333, 358, 381, 405, 427, 448, 473, 489, 516, 556; progress in 1884, 71; report, singular, 350; society of Brooklyn, 312; work at Nice, 350.
Astronomy, practical, 404.
ATKINSON, E. The application of science to the production and consumption of food, 234.
Atkinson, E., on competition and co-operation, 237; fire insurance, 236; silk-culture in United States, 236.
Atnah River, 357, 380.
Atropine, influence of, on circulation, 224.
Audubon collection of birds, 140.
Austrian expedition to the Kongo, 79.
Axe, stone, in Champlain valley, 233.
Axolotl, Mexican, 90; susceptibility to transformations, 263.
Aztec hieroglyphic writing, 260.

Babes. See Cornil and Babes.
Bacilli of cholera, 252.
Bacillus, chromogenous, 226.
Bacteria, 77; culture, methods of, 97.
BAILEY, S. C. H. A new meteoric iron from West Virginia, 563.
Bajenoff, N., on skulls of assassins and men of note, *ill.* 72.
Baker, H. B., on relation of rainfall and water-supply to cholera, 530.
BAKER, I. O. [illegible]
Barnes, [illegible]
C[illegible]
BASHORE, H. B. An Indian paint-cup, 3.
Battery, secondary, 60.
Beauchamp, W. M., on Iroquois clans, 231.
Bell, A. G., on astronomical day, 444.
Beloit college observatory, 200, 302.
Beloochistan, whirlwinds in, 118.
Ben Nevis meteorological observatory, *ill.* 459.
Bengal, earthquakes in, 159.
Berger, H. G., on influence of cocaine and atropine on circulation, 224.
Bergh, R., on the Challenger nudibranchs, 526.
Berlin exhibition of hygiene in 1882-83, reviewed, 36.
Bernard, Claude, statue to, *ill.* 117.
Berry, G. A., on civilization and eyesight, 195.
Bert, P., on chloroform as an anaesthetic, 154.
BERTHOUD, E. L. Abert's squirrel, 82.
BERTILLON, J. Height in France, *ill.* 523.
Bessemer plant, 342.
Bessey, C. E., on bisexuality of pond-scums, 224; demands of agriculture on botany, 193; inflorescence of Cuscuta glomerata, 225.
Bettany's Eminent doctors, reviewed, 571.
Biela's comet, 333; meteor stream, 489, 496, 519, 556.
BIGELOW, H. R. Recent contributions to the literature of micro-biology, 124.
Billings, F. S. Relation of animal diseases to public health, reviewed, 38.
Billings, J. S., on tables for vital statistics, 531.
Biological laboratory, marine, in England, 382; section of American association, 224.
Birds, Audubon collection of, 140; gigantic, of Madagascar, 418; origin of, 116; relationship with dinosaurs, 295.
Blackfoot tribes, 456.
Bland, T., 440.
Bohemia, Peruvian reptiles of, 97.
Bolivia, trade routes with Argentine republic, 555.
BOLTON, H. C. Chemical nomenclature, 368.
Bolton's Catalogue of scientific serials, reviewed, 256.
Bolts in boilers, 214.
Boltz, A., on the Cyclops, 452.
Bonar's Malthus and his work, reviewed, 567.
Bone-caves in Wales, 53.
Bones, 289.
Bordeaux observatory, 427, 449.
Bore-hole, deep, 118.
Borneo, gold in, 119; travels in, 472.
Boston school for electrical engineering, 150.
Botanical club at Ann Arbor, 99.
Botany, physiological, Goodale's, 471; practical, 98; Shaw school of, 21, 475.
BOUTELLE, C. O. What has the coast survey done for science? 558.
Bower and Vines's Practical botany, reviewed, 98.
Brady, G. S., on the Challenger Entomostraca, 527.
Brady, H. B., on the Challenger Foraminifera, 527.
Brain of extinct vertebrates, 360; localization of functions in, 379; physiology of, 521.
Branner, J. C., on glaciation of Lackawanna valley, 221.
[illegible], J. A., on rock-pail surfaces, 231.

Brazil, mangrove mud in, 120.
Bréon and Korthals on results of Krakatoa eruption, *ill.* 291.
Breslau water-supply, 34.
BREWER, W. H. The ginkgo-tree, 103.
Bridge, natural, *ill.* 67.
Bridges, railroad, 14.
BRINTON, D. G. The sculptures of Cozumalhuapa, 42.
British America, plains of, 468; museum of natural history, *ill.* 127.
BROOKS, W. K. Artificial propagation and cultivation of oysters in floats, 437.
Brooks comet, 381.
Brugmann's Philology, reviewed, 366.
Bryce, P. H., on small-pox in Canada, 533.
Buckton, G. B., on civilization and eyesight, 195.
Building-stones, decay of, 14.
Bulgaria and Bulgarians, 303.
Bulletin astronomique, 142.
BUNKER, F. S. Anti-cholera inoculation, 439; carbolic acid as a disinfectant, 566.
Burgess, E., 384, 477.
Burial customs, 233.
Burmah, 158; fate of, settled, 552; railways in, 552.
Burman dispute, *maps*, 399.
Burrill, T. J., on silk-culture, 194.
Busk on the Challenger Polyzoa, 527.
Butler, A. W., on remains at San Juan Teotihuacan, 231.
BUTLER, N. M. The study of logic in the scientific schools, 242.
Butterflies of North America, 307.

Cable, laying a, 545.
CAILLETET, L. The liquefaction of oxygen, *ill.* 51.
Caird's Social philosophy and religion of Comte, reviewed, 354.
Calendar, reform in, 324, 408.
California, archeological discovery in, 19.
Cameroons district, West Africa, 555.
Campanula americana, cross-fertilization in, 225.
Camphor, trade in, 451.
Canada, geological survey, 521; small-pox and vaccination in, 533.
Canadian plains, 565.
Cantwell's exploration of the Kowak River, 380.
Capello and Ivens in Central Africa, 489.
Capron, J. R., on civilization and eyesight, 195.
Carbolic acid as a disinfectant, 566.
Caroline Islands, *map*, 287.
Carpenter's Report on Crinoidea of the Challenger, reviewed, 138.
Carpenter, W. B., 493.
Carter, R. B., on civilization and eyesight, 195.
Cartographic work in Portugal, 59.
Cassino's Standard natural history, reviewed, 74.
Cassiopeiae (γ), spectrum of, 386.
Caucasus, explorations in, 492; petroleum in, 313.
Cereals, origin of, 73.
Chaffaujon's expedition on the Orinoco, 135, 157, 356.
Challenger expedition, work of, reviewed, 15, 54, 137, 138, 526.
Champlain valley, stone axe in, 233.
Chance's Report on North Carolina coalfields, reviewed, 548.
Chancellor, C. W., on causes of pulmonary consumption, 533.
CHANDLER, S. C., jun. The change in the great nebula in Andromeda, 247.
CHANNING, E. Bulgaria and Bulgarians, *maps*, 303; the Burman dispute, *maps*, 399.
CHAPPEL, J. E. Crystals in maple sirup, 539.
Charcoal burning, utilization of by-products in, 506.
Chauvin, Marie von, on Mexican axolotl, 90.
Chazal, P. E., on determination of nitrogen, 249.
Chemical laboratory, national, suggested, 536; nomenclature, 368.
Chemism, 211.
Chemistry, organic, 76; and public health, 208; section of American association, 210.
Chemists, agricultural, meeting of, 248; standing of, 538.
Chesapeake zoölogical laboratory, work at, 139.
Chevreul, a centenarian, 258.
Cheyne's observations on cholera microbe, 196.
Chicago-River pollution, 27.
CHILD, A. L. The English sparrow, 478.
China, medical missionary work in, *ill.* 570; need to study its history, 479; routes into, *map*, 12.
CHIPMAN, K. A. Color associations, 125.
Chloroform as an anaesthetic, 154.
Cholera, bacilli of, 252; inoculation, 439; microbe, 154, 196; prospects for England, 437; relation of rainfall and water-supply to, 532.
Christiani on localization of functions in brain, 379.
Chronograph, improvements in, 205.
Cicada, periodical, in Massachusetts, 4; premature appearance of, 3; song-notes of, 225, 264.
Cincinnati scientific lectures, 359.
Circumnavigation of the globe, 311.
Civilization and eyesight, 195.
Clam, edible, introduced on Atlantic coast, 53.
Clapp-Griffiths Bessemer plant, 342.
Claypole, E. W., on paleozoic sediments of Pennsylvania, 221.
Clayton, H. H., on weather-changes of long periods, 208.
Clowes's Practical chemistry, 117.
Coal-beds in Africa, 59; of North Carolina, 548; problems in study of, 217.
Coca, 119.
Cocaine, influence of, on circulation, 224.
Cocos Islands, poisonous waters in, 369.
Cohesion, new theory of, 274.
Cold, action of, on microphytes, 393; waves, 557.
Coleoptera of America, 382, 454.
Colman on adulteration of food, 248.
Colonial possessions of European countries, 313.
Colonization in Algeria, 317.
Color and other associations, 82, 125, *ill.* 142, 186, *ill.* 242, 337; of the sky, 316.
Colorado, blunder in maps of, 485.
Colquhoun's Burmah, 158.
Columbia college philosophical society, 360.
Combustion, effect of heating air upon, 100.
Comets II and III of 1884, *ill.* 47; 1885 II (Barnard), 310; Biela's, 333; Brooks, 381; discovery of, during solar eclipse, 313; observations at Greenwich, 405; Tuttle's, 139, 159; two new, 517.
Competition and co-operation, 237.
Composite photography, *ill.* 507; portrait of officers of American association, *ill.* 167; portraiture, 165, 283.
Comte's philosophy, 354.
Congdon on a spider covered with fungoid growth, 409.
Congress, American forestry, 181; of Americanists, 240; international geological, 158; medical, 61.
Congressional committee on scientific bureaus, 536.
CONN, H. W. A suggestion from modern embryology, 481.
Connecticut, height of land in, 4; legislation as to standard time, 62.
Consumption, causes of, 533; in Rhode Island, 512.
Consumptive period, 35.
Cooke's Scientific culture, reviewed, 114.
Cooley, M. E., on new smoke-burning device, 215; testing indicator-springs, 215.
Cooley system of creaming milk, 194.
Co-ordinates, polar, 206.
Cope, E. D., on brain and auditory organs of Peruvian saurian, 224.
Cordoba observatory, 427.
Cornell university, mechanical engineering at, 406.
Cornil and Babes's Bacteria, reviewed, 71.
Corona, photographing solar, 131, 202, 257.
Corpulence, 326.
CORTHELL, E. L. The ship-railway between the Atlantic and Pacific, *ill.*, *map*, 33.
Corwin, cruise of, 425.
Coulter, J. M., on relation of ovary and perianth in development of dicotyledons, 226.
Cowles, E. H. and A. H., and Mabery, C. F., on aluminum alloys, 210.
Cozumalhuapa sculptures, 42.
Crab invasion, 135.
Cremation, 463, 534.
Cretinism, 484.
Crinoids, stalked, 138.
CROSS, C. R. Electric measuring apparatus, 263.
Crystals in maple sirup, 520, 539.
Currents, equatorial, in solar and planetary atmospheres, 516; ocean, 140.
Cuscuta glomerata, inflorescence of, 225.
Cyclops, 453.
Cylinder condensation, 216.

D., W. M. The recent tornadoes, 252.
Dagincourt's Annuaire géologique, 189, 185.
Dakota group in Nebraska, 221; mounds, 232.
DALL, W. H. The arms of the octopus, 432; miocene deposits in Florida, 82; the native tribes of Alaska, 226.
DANA, J. D. Lower Silurian fossils at Canaan, N.Y., 283.
Dana, J. D., on Silurian fossils from New York, 220.
Danais Archippus, 409.
Dandelion, 193.
Danish expedition to east coast of Greenland, 448.
Darwin, Charles, *portrait*, 10; biography of, 276; statue to, 18.
Darwinism, public sentiment toward, 61.
Davenport tablet, *ill.* 564.
DAVIDSON, G. Recent volcanic activity in the United States; eruptions of Mount Baker, 262.
Davidson, Thomas, 359, 429.
Davis, W. T., on Danais Archippus, 409.
Deaf-mutes, normal school for instructors, 361.
Death, 226.
Death-rates of blacks and whites, 491.
Deaths, recent, 20, 157, 158, 220, 358, 429.
Deep sea, light in, 19.
Denifle's Origin of mediaeval universities, reviewed, 460.
Development of limbs, 409.
DEWALQUE, G. International geological congress at Berlin, 520.
DEWEY, J. Education and the health of women, 341.
Dinocerata, 454.
Dinosaurs and birds, 295.
Diseases, animal, 38; infectious, 220; of plants, 156.
Disinfectants, 485, 540; carbolic acid as, 566.
Disinfection, 393, 564.
Displacement of solar lines, 358.
Doctors, eminent, 571.
Dolley's Technology of bacteria investigation, reviewed, 97.
Dolphin, rare, 44.
Dome, floating, *ill.* 80.
Don, connecting, with Volga, 515.
DOOLITTLE, C. L. A bright meteor, 497.
Doolittle's Practical astronomy, reviewed, 404.
Dorsey, E. B., on English and American railroads, 14.
DORSEY, J. O. Linguistic studies at the Siletz agency, 202.
Dorsey, J. O., on Siletz agency, 230.
Drainage, 39.
Draper, D., on effect of ozone, 302.
Drought and weathercocks, 598.
Dry-rot, 160.
Dunnington, F. P., on laboratory practice, 211.
DUTTON, C. E. The latest volcanic eruption in the United States, 46; the theory of volcanoes, 255.

E., O. St. Petersburg letter, 430, 492.
E., S. Hypnotism, 504.
Earth, shrinkage of crust of, 220.
Earthquake shocks, 540.
Earthquakes in Bengal, 159; Iceland, 51; New Guinea, 117; at sea, 140, 180; Spanish, 393; in Switzerland, 59; in Victoria, B.C., 558.
EATON, H. W. Voss-Holtz electrical machine, 338.
Ebbinghaus's Experiments in memory, reviewed, 198.
Ebstein on corpulence, 395.
Eclipse, solar, of Sept. 9, 449.
Economic association, 239; essays, 111; science and statistics, section of American association, 78, 235.
Edelweiss, cultivation of, 80; protection of, 120.
Edinger on anatomy of nervous system, 407.
Edison, Thomas Alva, *portrait*, 145.
Ediefsen on acute articular rheumatism, 396.
Education and health of women, 341.
Educational association of Nipon, 370; meeting in Boston, 351.
Edwards's Butterflies of North America, reviewed, 307.
Effigy mounds in Iowa, *ill.* 453.
Egleston, T., on decay of building-stones, 14.
Egypt, stone implements in, 119.
Election excitement *versus* brains, 551.
Elective studies at Harvard, 499.
Electrical engineering school in Boston, 150; fire, ball of, 338; light industry, government interference with, in England, 537; lighting, 238; machine, 338, 363; measuring apparatus, 151, 283; railway, 180; at Frankfort, *ill.* 240; in New York, *ill.* 148; wires underground, 373.
Electrotechnical handbook, 447.
Elevation of earth's surface, causes of, 387.
Elizabeth Thompson fund, 141, 144, 421.
Elkin's work at Yale college observatory, 98.
Elliott, E. B., on electric lighting, 238; the silver question, 237.
Ellis's West African Islands, reviewed, 306.
Elting, I., on Dutch village-communities of the Hudson, 250.
Embryology, suggestion from, 481.
Encken on unity of mental life, 452.
Encyclopaedia Britannica on Greely's explorations, 463.
Endowment for research, 144.
Engelhardt on Admiral von Wrangell, 417.
Engineers, American society of civil, 13.
England, geographical instruction in, 78.
Ensilage in England, 500.
Entomology, economic, in Illinois, 261; in the national museum, 445.
Equatorial currents in solar and planetary atmospheres, 516.
Eskimo compared with languages of northern Asia, 300.
Ethical theory, types of, 136.
Ethnography of antarctic America, 92.
Ethnology, Mexican, 405.
Europe, geological map of, 377.
Evolution through attack and defence, 339.
Exploration in Indo-China, *ill.* 106.
Explosions as a means of propulsion, 374; mine, 117.
Eye, development of, *ill.* 194.
Eyesight and civilization, 195.

Factory hours in England, 40.
Fanning's water-supply for New York, 72.
FARNSWORTH, P. J. The English sparrow, 541.
Faroe Islands, 555.
FERREL, W. The temperature of the moon, 541.
Ferret, American, *ill.* 549.
Fertilization, cross, in Campanula americana, 225.
Fever, means of combating, 395.
Finland, 515.
Fiords, formation of, 280.
Fish, mortality of, 373; sleep of, 506.
Fish-culture, advance in, 353; stations in Switzerland, 160.
Fisher, C. H., on statistics of consumption in Rhode Island, 512.
Flash language, American, 283.
FLETCHER, Alice C. An average day in camp among the Sioux, 285; an evening in camp among the Omahas, 88.
Fletcher, A. C., on a Sioux camp, 233; war customs of Omahas, 231.
Flexure of transit instruments, 205, 387.
Flood Rock explosion, 315, 325, 326, 335, 353, 431.
Flora of Nantucket and Martha's Vineyard, 363.
Florida, miocene deposits in, 82.
Foi, H., on evidence of tail in man, 92.
Food, application of science to production and consumption of, 234.
Food-fishes, co-operation in preserving, 420.
Foods, human, 235.
Forbes on poisonous waters in Keeling Islands, 359.
Forestry congress, 181, 312.
Formative force of organisms, 4.
Formosa, 280.
France, height in, *ill.* 523.
FRANKLIN, Christine L. Science in common schools, 289.
FRANKLIN, F. Newcomb's Political economy, 495, 538.
FRAZER, P. International geological congress at Berlin, 540.
French academy in its origin, 105; growth of, 1635–1885, 190; use of, 281; association for the advancement of science, 99; expeditions, 259.
Freud's Coca, 119.
Friction and lost work, 275.
Fright, effect of, 550.
Fritsch's Permian reptiles of Bohemia, reviewed, 97.
Fruit, influence of locality upon, 193.
Fungi, 277.
Fungoid growth on spider, 409.

G. An unreliable treatise on disinfectants, 540.
G., A. Insular floras, 297.
GAGE, S. H. The limitations and value of histological investigation, 226.
GAGE, S. H. and S. P. Aquatic respiration of soft-shelled turtles, 283.
Gage, S. H. and S. P., on aquatic respiration of turtles, 225.
Gagem on the ascent of Popocatapetl, 390.
GALTON, F. Types and their inheritance, 268.
Galveston, deep water at, 215.
GANNETT, H. The magnetic declination in 1728, 283.
GARDINER, F., jun. An Arizona natural bridge, *ill.* 67.
Gas, natural, geology of, 42, 184; in Illinois, 520; wells, 441; of Ohio, 220.
Gastric juice injected in blood of animals, 409.
Gee. See Stewart and Gee.
Geikie's Geology, reviewed, 298.
Geographical education in England, 78, 538; news, 157; notes, 50, 71, 134, 311, 356, 380, 426, 448, 488, 515, 554; orthography, reform in, 110; society of Russia, 430.
Geographies, new series of, 557.
Geography, some works on, 298; study of, 349.
Geological annual, 159, 185; changes in New South Wales, 320; congress at Berlin, 158, 333, 376, 520, 540; history, contradictions in, 41; map of Europe, 377; survey of Canada, 521.
Geology and geography section of American association, 219; of Japan, 13; Ohio, 257; natural gas, 42, 184; recent progress in, 217; some works on, 298; of the Virginias, 17.
German physicians, fourth congress of, 395; possessions in Africa, 40; universities, *map*, 244.
Germination studies, 234.
Germs, effect of sunlight on, 475.
Gestation in horned toad, 185.
Gilbert, G. K., on old shore-line of Lake Ontario, 222.
Gilchrist trust, lectures under, 383.
GILL, T. Man's ancestry, 162.
Gillman, H., on burial customs, 233.
Ginkgo, etymology of, 84.
Ginkgo-tree, 4, 44, 103, 243.
Girard on composition of wheat grain, 415.
Glacial action in Canada, 388; pendulum in Switzerland, 42; region, Norwegian, 135.
Glaciation of Lackawanna valley, 221.
Glaciers, *ill.* 56; Swiss, 42, 59.
Glass, explosion of, 452; toughened, 293.
Goethe and vegetable morphology, 130.
Gold in Borneo, 119; near Constantinople, 572.
Goodale's Physiological botany, reviewed, 471.
GOODE, G. B. The care of pamphlets, 337; recent Challenger monographs, 526.
Gottsche's travels, 119.
Government, city, 236; science, 536; and the scientific bureaus, 530.
Grandidier on gigantic bird of Madagascar, 418.
Gravity determinations in and near Japan, 319.
Gray, Dr. Asa, 160; his seventy-fifth birthday, *ill.* 465, 477.
Gray's Explorations of east coast of Greenland, 448.
GRAY, E. P. Calendar reform, 408.
Great Basin region, reconnoissance in, 58.
Greely, A. W., arctic explorations of, 463; rescue of, 278.
Greenland, east coast of, visited, 448; exploration of, 558; native iron in, 280.
Guatemala, pre-Columbian history of, 514.
Günther's Geophysik, reviewed, 299.
Gutta-percha, substitute for, 160.

HAGEN, H. A. An old work on political economy, 562.
HAGUE, A. The decay of the obelisk, 510.
Haight, S. S., on accurate standards for surveyors' chains, 215.
HALE, H. Ethnography of antarctic America, 92.
Hale, H., on the Blackfoot tribes, 456.
HALL, A. Height of land in Connecticut, 4; Reineke Fuchs in political economy, 563.
HALLETT, H. S. Exploration in Indo-China, *ill.* 106.
Hamy's Mexican ethnology, reviewed, 405.
Hann, J., on the laws of temperature in the Austrian Alps, 459.
Hanno's voyage, 488.
Hare. See Woodhead and Hare.
Harkness, W., on flexure of transit instruments, 205, 387; the silver question, 237.
HARRINGTON, M. W. Lost rivers, 205.
Harrison, Sir J. P., on the great toe, 452.
Hartwell, E. M., on physical training in Germany, 534.
Harvard college observatory, 556; bequest to, 1, 384; elective studies at, 499.
HAYWARD, S. Color and other associations, *ill.* 338.
Hazen, H. A., on hygrometers and psychrometers, 387.
Health, public, 38; chemistry in the service of, 208; maxims of, 75.
Heat, obscure, 443.
Hehn and Stallybrass's Wanderings of plants and animals, reviewed, 426.
Height in France, *ill.* 523.
HEILPRIN, Angelo. The classification and paleontology of the U. S. tertiary deposits, 83.
Heim's Glaciers, reviewed, 56.
Helix cantiana, 418.
Hemsley's Botany of the Challenger, reviewed, 297.
HENNING, G. C. The English sparrow, 498.
HENSHAW, S. Coleoptera of America, 454.
Henshaw's List of American Coleoptera, 382.
HERRICK, F. H. An abnormal black bass, *ill.* 243; carnivorous habits of the striped squirrel, 338.
Hicks, H., on bone-caves in Wales, 53.
Hicks, L. E., on Dakota group in Nebraska, 221.
HIGGINSON, T. W. American flash language again, 283.
HILGARD, E. W. Absorption of moisture [illegible]

vapor by soils, 497; the classification and paleontology of the U. S. tertiary deposits, 44.
Hilgard, J. E., and his work, 139.
Hill, C. S., on statistical analysis, 237.
Histological investigations, 226.
Histology and microscopy section of American association, 227.
Historical association, 249.
Hitchcock, C. H. The latest slides in the White Mountains, 306; the recent landslide in the White Mountains, *ill.* 84.
Hitchcock, E., on Mastodon skeleton, 450.
Hoek on the Challenger Cirripedia, 527.
Hog cholera, 532.
Hogg, A., on deep water at Galveston, Tex., 215.
Holden, E. S. The care of pamphlets, 386; color and other associations, 242.
Holden, E. S., 398.
Hollick on Mitchella repens, 409.
Hooker, Sir J., 537.
Hooper's Cruise of the Corwin, reviewed, 425.
Hornaday's Travels in Borneo, reviewed, 472.
Horse-breeding, 447.
Hough, G. W., on improvements in printing-chronograph, 205.
Howe's Atlas of biology, reviewed, 462.
Howe, H. M. The Clapp-Griffiths Bessemer plant, 342.
Hoyt, J. W., on re-organization of U. S. executive departments, 237.
Hubbard, G. G. The Kongo Free State, *map*, 163.
Hubbard, G. W., on statistics of negroes, 237.
Hudson Bay expedition, 98, 350.
Huggins, W. An attempt to photograph the corona, 362.
Huliva's Water-supply of Breslau, 34.
Humanism in study of nature, 64.
Hunt, E. M., on sanitary and statistical nomenclature, 512.
Huperz on lungen gymnastik, 406.
Hurricanes, West Indian, 260.
Huxley, T. H., 334, 537; on Darwin, *portrait*, 10.
Hyatt, A. Cruise of the Arethusa, 384.
Hybridization of plants, 224.
Hydrographic surveys, 118.
Hydrophobia, 312, 398, 467; as a nervous disease, 508.
Hygiene, 278; exhibition of, 36.
Hygrometers, 387.
Hygrometry in the signal service, 536.
Hypnotism, 280, 504.

I., H. C. Star catalogues, 408.
Icebergs and temperature of sea, 118.
Iceland, 357; earthquake in, 51.
Illinois, economic entomology in, 261.
Immortality in modern thought, 126.
Incandescent lamps on railways, 153.
India, meteorites in, 333; names of mountains in, 280.
Indian commerce, 180; superstition, 59.
Indiana state academy of sciences, 302, 490.
Indicator springs, testing, 215.
Indo-China, exploration in, *ill.* 106.
Industries, Alaskan, 357, 427; Siberian, 348.
Infectious diseases, 299.
Ingersoll, E. Canadian plains, 565; the plains of British America, 468.
Ingersoll, E., on the effect of settlement of America upon its wild animals, 416.
Inoculation, anthrax, 120; for yellow-fever, 535.
Inscription rocks of Monhegan, 124.
Insular floras, 297.
Insurance, fire, 136.
International convention of science associations, 203; geological congress, 158, 333, 376, 520, 540; inventions exhibition, in London, 383, 429; medical congress, 61; sanitary conference at Rome, 101.
Iron industry of Russia, 452; native, in Greenland, 280; ores, 200.
Iroquois clans, 231.
Irrigation of the interior of New South Wales, 551.
Irving and Van Hise on crystalline form of quartz grains, 140.
Island, new, in Pacific Ocean, 555.
Italian African society, 50.
Italy, area of, 135.

J., J. Illustrations of recent Italian psychology, 413; productiveness, 479; racial characteristics of Jews, *ill.* 322; some reaction-time studies, 458.
J., W. Experiments in memory, 198; Lipp's psychological studies, 308.
Jacques, W. W. Underground wires, 6.
Jagnaux's Mineralogy, reviewed, 16.
James, E. J. Newcomb's Political economy, 470, 495, 517; recent land legislation in England, 455.
James, J. F. An abnormal Rudbeckia, *ill.* 103; the English sparrow, 497.
James, J. F., on leaves of the pitcher-plant, 296.
Japan, agriculture in, 314; atlas of, 558; geology of, 13; gravity determinations in, 319.
Japanese literature, Roman alphabet in, 158; patent law, 79.
Jastrow, J. Composite portraiture, 165, 283; infant psychology, 435.
Java, puppet-shows in, 251.
Jenkins, E. H., on method of estimating phosphoric acid, 248.
Jewish quarter in Rome, destruction of, 60.
Jews, racial characteristics of, *ill.* 322.
Joest's Around Africa, reviewed, *ill.* 114.
Johns Hopkins university, physics at, 547.
Johnson's Surveying, reviewed, 356.
Johnson, H. N., bequest of, 557.
Johnston, H. H., on an African smithy, *ill.* 347.
Journalists, reputation of Washington, 301.
Jumbo, 362.

K. Physics at Johns Hopkins, 547.
Kaan, H., on hypnotism, 280.
Kane's European butterflies, 535.
Keeling Islands, poisonous waters in, 369.
Kittler's Electrotechnical handbook, reviewed, 447.
Kobelt, W. Colonization in Algeria, 317.
Körösi's Comfort and longevity, reviewed, 87.
Kolbe, C. W., on laboratory practice, 212.
Kongo, 177; climate of, 100; conference, history of, 157; expedition to, 79; Free State, *map*, 163, 244.
Korean curios, 3.
Korthals. See Bréon and Korthals.
Kowak River, exploration of, 380.
Krakatoa eruption, results of, *ill.* 291.
Krause's Biography of Darwin, reviewed, 276.
Kunz, G. F. Korean curios, 3.
Kunz, G. F., on minerals from new localities, 222; petrified eyes, 410.
Kurile Islands, sea-level of, 120.

Labor statistics of Massachusetts, 389.
Laboratory practice, initiatory work for, 211.
La Flesche, F., on relationship among Omahas, 232.
Land legislation in England, 455.
Land-slide in the White Mountains, *ill.* 84.
Langley, J. W., on chemism, 211; necessity of knowledge of molecular physics to teach chemistry, 212.
Langley, S. P. False report of the fall of a meteorite in western Pennsylvania, 336.
Langley, S. P., on invisible radiations, 206; temperature of moon's surface, 412, 443.
Lankester, E. R., 537.
Lapland, height of mountains in, 515.
Lathe as instrument of precision, 215.
Latitude, change in, 118.
Latour's Chaleur animale, 535.
Laughlin's Study of political economy, reviewed, 534.
Lea, sanitary condition of, 334.
LeConte, Joseph. Earthquake shocks more violent on the surface than in mines, 540; immortality in modern thought, 126; the results of shad propagation on the Atlantic coast, 520.
Legislation, land, in England, 455.
Lehmann's Consumptive period, 35.
Lena polar station, 492.
Lesley, J. P. Address before American association, 168.
Lepidoptera, collection of, 50.
Lettuce, 193.
Lewis, T. H. Effigy mounds in Iowa, *ill.* 453.
Lick observatory, *ill.* 186, 398, 428, 556; crown disk for, 181; future of, 181.
Liebermeister, C., on infectious diseases, 299.
Light in deep sea, 19; method for determining unit of, 183.
Lightning, injury to monument by, *ill.* 288; and the Washington monument, 383.
Limbs, development of, 409.
Linguistic studies, 262.
Lipp's Psychological studies, reviewed, 308.
Lockington, W. N., on causes of elevation of earth's surface, 387.
Locusts, injury by, 236.
Logic, study of, in scientific schools, 262.
Lomb prizes, 534.
London fog, 494.
Longevity and comfort, 87.
Longitude signals to Mexico, 405.
Longitudes, coast-survey system of, 474.
Loomis, E. Contributions to meteorology, 62; low-pressure areas, 79.
Lucy-Fossarieu's Ethnography of antarctic America, reviewed, 92.
Lumsden on Afghan tribes, *ill.* 69.
Lungen gymnastik, 406.
Luquer, T. T. P. Color and other associations, *ill.* 337.
Luxor, excavation of temple of, *ill.* 370.
Lyman, B. Smith. The etymology of ginkgo, 84.

M. Laying a cable, 545.
M., A. The mind-cure, 543.
M., C. S. Has man a tail? 92.
Mabery, C. F., on laboratory practice, 211. See also Cowles and Mabery.
McAdams, W., on Indian mounds in Dakota, 232.
McBride, T. H. Vegetable morphology a century ago. — Goethe, 130.
McDonald on shad propagation, 433.
Macedonia, nationalities of, 451.
McFarland, W. Flood Rock explosion, 481.
McGill college, science at, 374.
McIntosh, W. C. Phosphorescence of marine animals, 295.
McKendrick on the action of cold on microphytes, 393.
McMath, R. E. Velocity and sediment, 2.
Mad stone, 123, 168.
Madagascar, gigantic bird of, 418.
Magazines, scientific articles in, 120, 160, 490.
Magnetic constants of steel cruisers, 361; declination in 1728, 244, 283.
Magnetism, terrestrial, in Russia, 134.
Malthus and his work, 567.
Mammals, aestivation of, 402.
Man, ancestry of, 162; evidence of tail in, 81, 92; and mastodon, 375.
Mangrove mud in Brazil, 120.
Mann, B. P. The care of pamphlets, 407, 432.
Map of Europe, geological, 377.
Maple sirup, crystals in, 520, 539.
Maps of North America, inaccuracy of, 529.
Marsh, O. C., on Dinocerata, 454; size of brains of extinct vertebrates, 380.
Martha's Vineyard, cable to, 545; flora of, 363.
Martin, Miss L. J., on laboratory practice, 212.
Martineau's Types of ethical theory, reviewed, 136.
Massachusetts labor statistics, 389; teachers' associations, 450.
Mastodon and man, 375; skeleton near Geneva, N.Y., 450.

Mathematical prize, 259; research, comparative activity of different nations in, 181.
Mathematics and astronomy section of American association, 204.
Matter, properties of, 96.
Maxwell's demons, 83.
Measurements, standards of, 215.
Mechanical engineering at Cornell, 406; methods of teaching, 216; section of American association, 78, 214.
Mediæval universities, 460.
Medicine in the middle ages, *ill.* 40.
Mees, C. L., on laboratory practice, 212.
MEIGS, M. C. Ball of electric fire, 338; the Washington monument and the lightning stroke of June 5, 63.
Meion's From Palermo to Tunis, reviewed, 447.
Memory, experiments in, 198.
MENDENHALL, T. C. The explosion at Flood Rock, 326.
Mendenhall, T. C., on reaction time, 387; voltmeters, 387.
Mental life, unity of, 452; suggestion, 451.
Mercurial vapor, absorption of, by soils, 497.
Metallurgy, progress in, 525.
Meteoric iron from West Virginia, 563.
Meteorites, false report of, 325, 336; in India, 333.
Meteorological notes, 556; observations, curious, 279; observatory on Ben Nevis, *ill.* 459; observatory, floating, 117; records, telemetric aid to, 194; station in New Guinea, 159.
Meteorology in New England, 557.
Meteors abundant Aug. 10, 142; Biela, 489, 496, 519, 556; bright, 497; fall of, at sea, 59; November, 279, 428.
Mexican ethnology, 405.
MEYER, O. The classification and paleontology of the U. S. tertiary deposits, 143.
MICHELS, J. The English sparrow, 541.
Michie's Life of Gen. Upton, reviewed, 404.
Michigan university, biology in, 359.
Micro-biology, recent contributions to literature of, 124.
Microbe, cholera, 154, 196.
Microphytes, action of cold on, 393.
Micropterus salmoides, *ill.* 243.
MILLER, G. S. Color and other associations, 243.
Mimicry among Mollusca, 9.
Mind-cure, 543.
Mineral products of United States, 99; resources of Askabad, 359.
Minerals from new localities, 222.
Mines, earthquake shocks in, 540; loss of life in, 538.
MINOT, C. S. Color associations with the months, 82; the formative force of organisms, 4; a new endowment for research, 144; physiology of the brain, 521.
Minot, C. S., on death, 226; morphology of supra-renal capsules, 226; number-habit, 233.
Miocene deposits, 82.
Mitchella repens, 409.
Mirage on Lake Wettern, 158.
Molecular physics and theoretical chemistry, 212.
Mollusca, mimicry among, 9.
Monhegan, inscription rocks on, 124.
Monk Island, 535.
Moon's surface, temperature of, 412, 443, 541.
Morphology, vegetable, 130.
Morris, C., on evolution through attack and defence, 339.
Mosquitoes *vs.* trout, 197.
Mounds in Dakota, 232; effigy, in Iowa, *ill.* 453.
Mount Baker, eruptions of, 262.
Mountain structure, trend and crustal surplusage in, 220.
Mountains in Lapland, height of, 515.
Mourning, forms of, 407.
on mosquitoes *vs.* trout, 197.
-ducational, of
0, 142.
Nantucket, cable to, 545; flora of, 363.
National academy of sciences, 419, 443, 449; chemical laboratory suggested, 536; university, 509, 539.
Natural history, standard, 74.
Nautical almanacs, amalgamation of, 160.
Navigation, aerial, 20.
Nebula in Andromeda, new star in, 247, 310, 359, 473; spectrum of, *ill.* 262, 333, 336.
Negroes, statistics of, 237.
Nervous system, anatomy of, 407.
Neumann and Partsch's Physical geography of Greece, reviewed, 299.
New England meteorological society, 490; meteorology in, 557.
New Grenada, resources of, 314.
New Guinea, earthquakes in, 117; German-English boundaries in, 60.
New Princeton review, the, 551.
New South Wales, geological changes in, 320; irrigation of the interior of, 551.
New York, convocation of university of, 61; electric railway in, *ill.* 148; microscopical society, 410; water-supply, 72.
NEWCOMB, S. Newcomb's Political economy, 495.
Newcomb, S., on the astronomical day, 444; Political economy, 470, 495, 517, 538.
Newton, Hubert A., *portrait*, 161; effect of small bodies passing near a planet on planet's velocity, 204.
Nice, astronomical work at, 350; observatory, floating dome of, *ill.* 80.
Nichols, E. L., on spectrum of unclouded sky, 207.
NICHOLS, W. R. Chemistry in the service of public health, 208.
Nipon central educational association, 370.
Nitrogen, determination of, 249.
Nomenclature, chemical, 368; river, 321; sanitary, 512.
Nordenfelt submarine boat, *ill.* 394.
North Carolina coal-fields, 548.
Norway, northern, 515.
Norwegian fiords, 280; glacial region, 135.
November meteors, 279, 428.
Number-habit, 233.
Nuremberg, exhibition of metal-work at, 158.

O., E. The swindling geologist, 453.
Obelisk, the decay of the, 510.
Observatory, floating, meteorological, 117.
Octopus, arms of, 432.
Ohio geology, 257.
Ohm standards, 436.
Oil-wells of Ohio, 220.
Omahas, evening in camp among, 88; relationship among, 232; war customs of, 231.
Ontario, Lake, old shore-line of, 222.
Orinoco, expedition on, 135; travels on, 356.
Orion, new star in, 556, 558.
Ornithology, economic, 78, 259.
Orthography, geographical, 110.
ORTON, E. Problems in the study of coal, with a sketch of recent progressive geology, 217.
Orton, E., on Ohio gas and oil wells, 220; Report on Ohio geology, reviewed, 257.
OSBORN, H. L. Mimicry among marine Mollusca, 9.
Ovary of dicotyledons, 226.
Oxidation processes in animal tissues, 508.
Oxus, old bed of, 516.
Oxygen, liquefaction of, *ill.* 51; manufacture of, 99.
Oysters, culture of, 465; natural enemies of, 392; propagation and cultivation of, 437.
Ozone in the atmosphere, 302.

Paine bequest, 1, 384.
Paint-cup, Indian, 3.
Palmer, G. H., on elective studies at Harvard, 499.
Palmer's Edible and poisonous fungi, reviewed, 277.
Palpi of insects, 475.
Pamphlets, care of, 337, 386, 407, 432.
Panama canal, 421, 503.
Paneth, J., on irritability of cerebral cortex, 521.
Paper blocks for masonry, 484.
Parallax of 40 o^2 Eridani, 358.
Paris exhibition of industry, 138; telephone in, *map*, 110.
Pasteur and hydrophobia, 312, 398, 467; Newark mad dog, 508.
Patagonia, Argentine expeditions into, 157.
Patent law, Japanese, 79.
PATRIOT. The Kongo Free State, 244.
PAUL, H. M. The Biela comet meteor-stream, 519; Flood Rock explosion, 431; recent gravity determinations in and near Japan, 319; reform in our calendar, 324; stars in rapid motion, 483; temperature of the moon's surface, 412; timing the Flood Rock explosion, 325.
PEABODY, F. G. Types of ethical theory 136.
Pear-blight, 225.
Peirce, C. S., and U. S. coast survey, 158.
Pennsylvania geological survey, 41, 100; paleozoic sediments of, 221.
Peptone, absorption and assimilation of, 116.
Perez on infant psychology, 435.
Perkins, G. H., on stone axe in Champlain valley, 233.
Personal equation, 449.
Perthes' services to geography, 398.
Peruvian reptiles, 97.
Petrified eyes, 410.
Petroleum in Caucasus, 313.
Philadelphia academy of natural sciences, 339, 363, 387, 409, 557.
Philology, the new, 366.
Philosophy, the new, 474.
Phosphorescence of marine animals, 295.
Phosphoric acid, method of estimating, 248.
Photographing solar corona, 131, 362, 387.
Photography, books on, 426; composite, *ill.* 507; prize in, 476; stellar, 443.
Photometers, 473.
Phrynosoma, gestation in, 185.
Physical science, lectures on, 96; textbooks, 96; training in Germany, 534.
Physicians, fourth congress of German, 395.
Physics, elementary, 96; at Johns Hopkins, 547; section of American association, 206.
Pickering, E. C., on stellar photography, 443.
PICKERING, W. H. An attempt to photograph the solar corona without an eclipse, 131, 362, 387; the color of the sky, 316; a method for determining the unit of light, 183.
PICKERNELL, F. A. The electric railway in New York, *ill.* 148.
Pitcher-plant, leaves of, 296.
Pilot chart, improvements in, 279.
Plains of British America, 468; Canadian, 565.
Planet, velocity of, 204.
Plants, diseases of, 156, 203; hybridization of, 224.
Playfair, Sir L., on state aid to science, 325.
Plunkett's Women, plumbers, and doctors, reviewed, 57.
POHLMAN, J. An American Silurian scorpion, *ill.* 183.
Point Barrow station, 446.
Poisonous meat, 419.
Polar station on the Lena, 492.
Poleck on dry-rot, 160.
Poléjaeff on the Challenger sponges, 527.
Political economy, method of teaching, 534; Newcomb's, 470, 495, 517, 538; old work on, 562; recent progress in, 411; Reineke Fuchs in, 563; science in France, 482; 'scientists,' 253.
Pollution, river, 27.
Polygonum, hybridity in, 180.
Popocatapetl, ascent of, 390.
Portolano, Italian, of the sixteenth century, 250.

Portugal, cartographic work in, 59.
Portuguese children, songs of, 311.
Potash fertilizers, 260; method of estimating, 249.
Potassic hydrate and alum, reaction between, 211.
POTEAT, W. L. Untimely death of a chipping-sparrow, 63.
POWELL, E. P. Color and other associations, 338; science in common schools, 336.
Prehistoric remains in Switzerland, 20.
Prescott, A. B., on laboratory practice, 211.
President, message of, 507; and Professor Agassiz, 302.
Pressure-motor, universal form of, 214.
Prices from 1873 to 1884, 365.
Prize of Berlin society for advancement of manufacture, 119; mathematical, 259; in photography, 476.
Prizes, Lomb, 534.
Proceedings of societies, 339, 363, 387, 409.
Productiveness, 479.
Prony-brake, 216.
Psychical research, western society for, 78.
Psychological studies, 308.
Psychology, advances in French, 398; infant, 435; Italian, 413.
Psychrometers, 387.
Publications, new, 340, 364, 388.
PUMPELLY, R. Soils and health, 30.
Puppet-shows in Java, *ill.* 251.
Puritan, yacht, *ill.* 168.
PUTNAM, F. W. Man and the mastodon, 375.
Putorius nigripes, *ill.* 549.

Quarantines, 23.
Quartz grains in sandstones, 140.
Quaternary deposits of Illinois, 221.

R., C. Recent progress in political economy, 411.
R., R. An archeologist in trouble, 386.
Radiations, invisible, 206.
Railways in Burmah, 552; electric, 180, *ill.* 240; in New York, *ill.* 148; English and American, 14; incandescent lamps on, 153.
Rainfall, relation of, to cholera, 532.
Randolph, L. S., on stay-bolts in boilers, 214.
RATHBUN, R. A crab invasion, 135.
RAUCH, J. H. Chicago-River pollution, 27.
Rayleigh on civilization and eyesight, 195.
Reaction time, 387, 458.
REED, Sir E. J. The forms of ships, 52, 569.
Reemelin, C., on city government, 236.
Refraction, terrestrial, 333.
Reifsnyder, Elizabeth, medical work of, in China, *ill.* 570.
REILLY, F. W. How to deal with yellow-fever, 25.
REMSEN, Ira. City wells, 32.
Remsen's Organic chemistry, reviewed, 76.
Renal capsules, morphology of, 226.
Respiration in turtles, 225, 283.
Rheumatism, acute articular, 396.
Rhode Island, consumption in, 512.
Richards's explorations in East Africa, 311.
RICHARDS, Ellen H. Science in common schools, 289.
RILEY, C. V. Periodical cicada in Massachusetts, 4; premature appearance of the periodical cicada, 3; the song-notes of the periodical cicada, 264.
Riley, C. V., gift of, to the national museum, 441; on injury by locusts, 236; silk-culture in the United States, 236; song-notes of periodical cicada, 225.
River nomenclature, 321.
Rivers, lost, 265.
Rock-salt surfaces, 207.
Rockwell, C. H., on almucantar observations, 206.
Rodrigues, J. C., on the Panama canal, 503.
Rogers, W. A., on standards of measurement, 215.
Rogers's Geology of the Virginias, reviewed, 17.
Rohé's Hygiene, reviewed, 278.
Rome, international sanitary conference at, 101.
Rougerie's apparatus for artificial winds, 462.
Royal society of London, entrance to, 351, 407, 456; officers of, 537; presidency of, 442.
Rudbeckia, abnormal, *ill.* 103.
RUHEIT, C. Color associations with the months, *ill.* 142.
RUSSELL, I. C. North Carolina coal-fields, 548.
Russell, I. C., reconnoissance of, in the Great-Basin region, 58.
Russia, geographical society of, 430; iron industry of, 452; terrestrial magnetism in, 134; weather in, 430.
RYDER, J. A. A new system of oyster-culture, 465; the swimming habits of the sunfish, *ill.* 103.
Ryder, J. A., on development of limbs, 409.

S., C. A. The magnetic declination in 1728, 344.
S., M. A. Doctors and their work, 571; fourth congress of German physicians, 395.
S., O. T. The spectrum of γ Cassiopeiae, 386; spectrum of the great nebula in Andromeda, *ill.* 262, 336.
St. Petersburg society of naturalists, 492.
SALISBURY, R. D. The swindling geologist, 408.
Salmon, D. E., on virus of hog cholera, 532.
Salmon, D. E., and Smith, T., on new chromogenous bacillus, 226.
SAMPSON, F. A. A mad stone, 123.
San Juan Teotihuacan, remains at, 231.
Sanborn, J. W., on customs of Senecas, 233.
Sanitary condition of the Lea and Thames, 334; conference, 101; nomenclature, 512.
Sanitation, household, 57; and science, 21.
Saurian, brain and auditory organs of, 224.
SAWYER, E. F. A new variable, 498.
SCHIMPFF, R. D. The Biela meteors, 519.
Schley and Soley's Rescue of Greely, reviewed, 278.
Schmitz's Consumptive period, reviewed, 35.
School of botany, 21; for electrical engineering, 150.
Schools, science in, 336.
Schübeler on origin of cereals, 73.
Schuyler, E., on materials for American history in foreign archives, 250.
Schwatka's Nimrod in the north, reviewed, 554.
Science in common schools, 289, 336; and the state, 325.
Science, removal of, to New York, 384.
Scientific articles in the general magazines, 490; bureaus, congressional committee on, 536; and the government, 530; culture, 114; titles, 464.
Scorpion, American Silurian, *ill.* 87, *ill.* 183, 184.
Scums, bisexuality of, 224.
Sea, temperature of, 118.
Sea-level, oscillations of, 120.
SEARS, J. H. Crystals in maple sirup, 520.
Sediment and velocity, 2.
Seismology, 458; in the United States, 491.
Selenium, its sensitiveness to light, 359.
Senecas, customs of, 233.
Settlement, effect of, on wild animals, 416.
Shad propagation on Atlantic coast, 433, 520.
SHALER, N. S. Humanism in the study of nature, 64.
Sharp, B., on development of the eye, *ill.* 194.
Shaw school of botany, 475.
Ship-railway, Tehuantepec, *ill.*, *map*, 33.
Ships, forms of, 52, 569.
Shrinkage of earth's crust, 290.
SHUFELDT, R. W. The Mexican axolotl and its susceptibility to transformations, 268; probable period of gestation in the horned toad, 135; Zuñian cosmotions of animal forms as shown in pottery, *ill.* 266.
Siberian industries, 348; interest in geographical explorations, 516; railway, 516.
Sibiriakoff's journey in Siberia, 157.
Siemens, F., on toughened glass, 293.
Siletz agency, 230.
Silk-culture, 194; in the United States, 296.
Silurian fossils from New York, 220; at Canaan, N.Y., 283; scorpion, *ill.* 87, *ill.* 183, 184.
Silver question, 237.
SIOUX, in camp among, 233, 285.
Skulls of assassins and men of note, *ill.* 72.
Sky, color of, 316; spectrum of, 207.
SLACK, F. M. Color and other associations, 186.
Slave trade, 441.
Sleep, activity of mind during, 344; of fishes, 506.
Slides in the White Mountains, *ill.* 84, 306.
Small pox in Canada, 533; as a Canadian disease, 373.
Smith, B., 140.
SMITH, T. Woodhead and Hare's Pathological mycology, 316.
Smith, T. See Salmon and Smith.
Smithsonian price-list of publications, 535.
Smoke-burning device, 215.
Societies, calendar of, 340, 364, 410; learned, use and abuse of, 351; proceedings of, 339, 363, 387, 409; scientific, of America, 536.
Society for promotion of agricultural science, 2, 78, 193.
Soil, freezing of, 314.
Soils and health, 30.
Solar ring, 159.
Sorghum, extraction of sugar from, 534.
South Kensington chair of natural history, 382.
SOUTHWICK, E. B. The ginkgo-tree, 262.
Spanish earthquakes, 393.
Sparrow, English, 416, 478, 497, 520, 541, 563; untimely death of, 63.
SPAULDING, R. The scenery of Arizona, 44.
Spectral analysis of atmospheric elements, 448.
Spectro-photometer and ophthalmospectroscope, 208.
Spectrum of γ Cassiopeiae, 386; of nebula in Andromeda, *ill.* 262, 333, 336; of sky, 207.
Sprinklers, automatic, 215.
Squall, singular, 450.
Squirrel, habits of, 338.
Stalactites, 348.
Stallybrass. See Hehn and Stallybrass.
Standards for surveyors' chains, 215.
Stanley's Kongo, reviewed, *ill.* 177.
Star catalogues, 408; new, in Orion, 556, 558.
Stars, comparison, 427, 474; in rapid motion, 483.
State aid to science, 325; science and, 315.
Staten Island natural science association, 409.
Statistical analysis, 237.
Statistics of negroes, 237; vital, tables for, 531.
Stellar magnitudes, 427; photography, 443.
Steinen's explorations of the Xingu, 153.
Steiner's Physiology of the brain, reviewed, 521.
Stepniak's Russia under the tzars, reviewed, 355, 478.
STERNBERG, G. M. Disinfection, 336, 564; the international sanitary conference at Rome, 101.
STEVENS, W. LeC. Voss-Holtz electrical machine, 363.
Stewart and Gee's Elementary physics, reviewed, 96.
STONE, G. H. The inscription rock on the island of Monhegan, 194.
STONE, W. E. The ginkgo-tree
Stone implements in E[illegible]
STORER, F. H. A me
Stratigraphy, co
STRONG, [illegible]

Sturtevant, E. L., on dandelion, 193; germination, 224; hybridization of plants, 224; influence of locality on fruit, 193; lettuce, 193.
Submarine boat, *ill.* 394.
Sugar, extraction of, 524; industry, 453.
Sumatra, petroleum in, 40.
Sumner's Economic essays, reviewed, 111.
Sunfish, swimming habits of, *ill.* 103.
Sunlight, effect of, on germs, 475.
Surveys, hydrographic, 118.
SVENONIUS, F. Annuaire géologique universel, 185.
Swindling geologist, 408, 453.
Swiss fish cultural stations, 160; glaciers, growth of, 59.
Switzerland, earthquakes in, 59; glacial pendulum in, 42; prehistoric remains in, 20.

Tail in man, evidence of, 81, 92.
Tait's Lectures on physical science, reviewed, 96; Properties of matter, reviewed, 96.
Tamias striatus, 338.
TARR, R. S. The English sparrow, 416, 520, 563; natural enemies of oysters, 392.
Tauri (α), occultations of, 489.
TAUSSIG, F. W. Prices from 1873 to 1884, 365.
Taylor, W. B., on shrinkage of earth's crust, 220.
Teachers' association, 450; school of science in Boston, 477.
Teaching as a profession, 529.
Tehuantepec ship-railway, *ill.*, *map*, 33.
Telegraph, use of, in England, 537.
Telephone in Paris, *map*, 110; use of, for military purposes, *ill.* 239.
Telephonic vibrations, 476.
Telescopes, small *versus* large, 381.
Telpher line, 429.
Telpherage, *ill.* 513.
Temperature in Austrian Alps, 459; of moon's surface, 412, 443, 541; proposition for wholesale change of, in the Atlantic states, 428.
Tertiary deposits, classification and paleontology of, 44, 83, 143.
Thames, sanitary condition of, 335.
Theosophical society's censorship of the American society for psychical research, 81.
Theosophist in Washington, 453.
Thermodynamics, second law of, 212.
Thibet, journey in, 18.
THOMAS, C. The Davenport tablet, *ill.* 564.
Thomas, J. J., on influence of locality on fruit, 193.
Thompson fund, 141, 144, 421.
Thoroddson's explorations in Iceland, 357.
Thought-transference, *ill.* 8.
Thurston, Prof. R. H., 79; on cylinder condensation, 216; Friction and lost work, reviewed, 275; on Prony-brake, 216; on teaching mechanical engineering, 216.
Timber, preservation of, 14.
Time, change to civil, 80; legislation as to standard, 62.
Titcomb's Mind-cure, reviewed, 543.
Titles, scientific, 464.
TODD, D. P. The future of the Lick observatory, 181.
Todd, D. P., on pressure-motor, 214.
Toe, the great, in different nations, 452.
Tornado at Aden, 58; an unusual, 556.
Tornadoes, prediction of, 557; recent, 252.
TOY, C. H. The new philology, 366.
Transcaspian railway, 360.
Transit instruments, flexure of, 387.
Trout and mosquitoes, 197.
TRUE, F. W. The American ferret, *ill.* 549; the British museum of natural history, *ill.* 127; a rare dolphin, 44.
Turner on human crania, 526.
Turtles, aquatic respiration in, 225, 283.
...le's comet, 139, 159.
...ll fellowships, 45.
...their inheritance, 268.
...er in autumn, 374.
...ss, 2, 6, 373.
...asure, 381.

U. S. coast survey, 158, 349, 491; official scrutiny of, 121; and 'political scientists,' 253; resolutions of American association concerning, 204; system of longitudes, 474; what has it done for science? 558; who should be superintendent, 241; department of agriculture, 453; entomological commission, 315; executive departments, re-organization of, 237; fish commission, 301; geological survey, answer to charges against, 419, 424; unfounded report of irregularities in, 261; mineral products, 99; national museum, entomology in, 445; naval observatory, curious observations at, 279; naval museum of hygiene, 491; recent volcanic eruption in, 46; signal office, advisability of making it a civil bureau, 397; hygrometry in, 536; trouble with students, 397; silk-culture in, 236; tertiary deposits, classification and paleontology of, 44, 83, 143.
Universities, German, *map*, 244; mediaeval, 460.
University of Michigan, biology in, 359; a national, 509, 539; of New York, convocation of, 61.
Upton, Gen. E., Life of, reviewed, 404.

Vaccination in Canada, 533.
Van Ermengem on cholera microbe, reviewed, 154.
Van Hise. See Irving and Van Hise.
VANDERPOEL, S. O. Quarantines and their scientific value, 23.
Variable, a new, 498.
Vegetable morphology a century ago, 130.
Vélain's Theory of volcanoes, reviewed, 255.
Velocity and sediment, 2.
Vertebrates, educational museums of, 222.
Vessel, attempt to propel, by explosions, 374.
Vetter, B., on relationships between dinosaurs and birds, 295.
Victoria, B.C., earthquake in, 558.
Village communities, Dutch, of the Hudson, 250.
Vines. See Bower and Vines.
Virginias, geology of, 17.
Vital statistics, tables for, 531.
Vivisection at Oxford, 429.
Volcanic activity in the United States, 262; dust east of the Rocky Mountains, 63; eruption, recent, in the United States, 46.
Volcanoes, theory of, 255.
Volga, connecting, with Don, 515.
Voltmeters, 387.
Voss-Holtz electrical machine, 338, 363.

W. London letter, 334, 382, 429, 493, 537.
WADSWORTH, M. E. Volcanic dust east of the Rocky Mountains, 63.
Wadsworth, M. E., 59.
Wallace's Bad times, reviewed, 553.
WARD, L. F. A convenient system of river nomenclature, 321; a national university, 539.
Warder, R. B., on laboratory practice, 211.
Waring's How to drain a house, reviewed, 39.
Washburn university publications, reviewed, 461.
Washington, agricultural convention at, 68; monument and lightning stroke of June 5, 63; monument protected from lightning, 383; philosophical society, 387.
Washington, portraits of, 300.
Water-supply of Breslau, 34; for New York, 72; relation of, to cholera, 532.
Wead, C. K., on combined spectro-photometer and ophthalmospectroscope, 208.
Weather changes of long period, 208; in Russia, 430; signals, *ill.* 181.
Weathercocks and drought, 528.
WEBB, J. B. The second law of thermodynamics, 212.
Webb, J. B., on lathe as instrument of precision, 215; polar co-ordinates, 206; teaching mechanical engineering, 216.
Wells, city, 32.
West Virginia, new meteoric iron from, 563.
Western society for psychical research, 78.
Whaling catch, Alaskan, 259.
Wheat grain, composition of, 415.
Whirlwinds in Beloochistan, 118.
WHITE, I. C. The geology of natural gas, 42.
White ants in Boston, 477.
White Mountain land-slides, *ill.* 84, 306.
WHITFIELD, R. P. An American Silurian scorpion, *ill.* 87, 184; the ginkgo-tree, 4.
WHITING, Harold. Maxwell's demons, 83.
Whiting, H., on new theory of cohesion, 274.
Wight's Maxims of public health, reviewed, 75.
Wild animals, effect of settlement of America on, 416.
WILDER, B. G. Educational museums of vertebrates, 222.
Wilder, B. G., on serrated appendages of Amia, 226.
Wiley, H. W., on adulteration of honey, 210; extraction of sugar from sorghum and sugar-cane, 524; laboratory practice, 211; method of estimating potash, 249.
WILKINSON, C. S. Geological changes in New South Wales, 320.
Will-power, experimental study of, 260.
Willcox, J., on glacial action in Canada, 388.
Willet's Point, change of latitude of, 118.
Williams, H. S., on comparative stratigraphy, 220.
Wilson, J. M., on railroad-bridges, 14.
Winchell, Alexander, on trend and crustal surplusage in mountain structure, 220.
Winchell, N. H., on alloy of copper and silver, 231.
Windmill as a prime mover, 258.
Winds, artificial, 462.
WINLOCK, W. C. Comets II and III of 1884, *ill.* 47.
WINSLOW, Arthur. Color and other associations, *ill.* 243.
Winsor, J., on an Italian portolano of sixteenth century, 250.
Wires, underground, 2, 6.
WOEIKOF, A. Stepniak's Russia under the czars, 478.
Wolff's Windmill as a prime mover, reviewed, 258.
Women, education and health of, 341.
Wood, H. C., on injecting gastric juice in blood, 409.
Woodbury, C. J. H., on automatic sprinklers, 215.
Woodhead and Hare's Pathological mycology, 316.
Woolfe exploration of arctic coast of Alaska, 381.
Worthen, A. H., on quaternary deposits of Illinois, 221.
Wrangell, F. von, 417.
WRIGHT, A. W. Electrical measuring instruments, 151.
Wuelker's History of Anglo-Saxon, reviewed, 487.

Xingu, explorations of, 133.

Y. Boston letter, 384, 476.
Yale college observatory, work at, 98.
Yellow-fever, 25; inoculation for, 535.
Yellowstone Park, game in, 406.
Young, A. V. E., on reaction between potassic hydrate and alum, 211.
YOUNG, C. A. The Biela meteors, 496; Flood Rock explosion observed at Princeton, N.J., 335.
Young, C. A., on astronomical day, 444.
Yucca angustifolia, chemical study of, 210.

Z. Washington letter, 314, 361, 383, 453, 491, 536.
Zimmermann's Atlas of plant-diseases, reviewed, 156.
Zoölogical gardens in America, 420; journal, new, 486.
Zuñian conceptions of animal forms, *ill.* 266.

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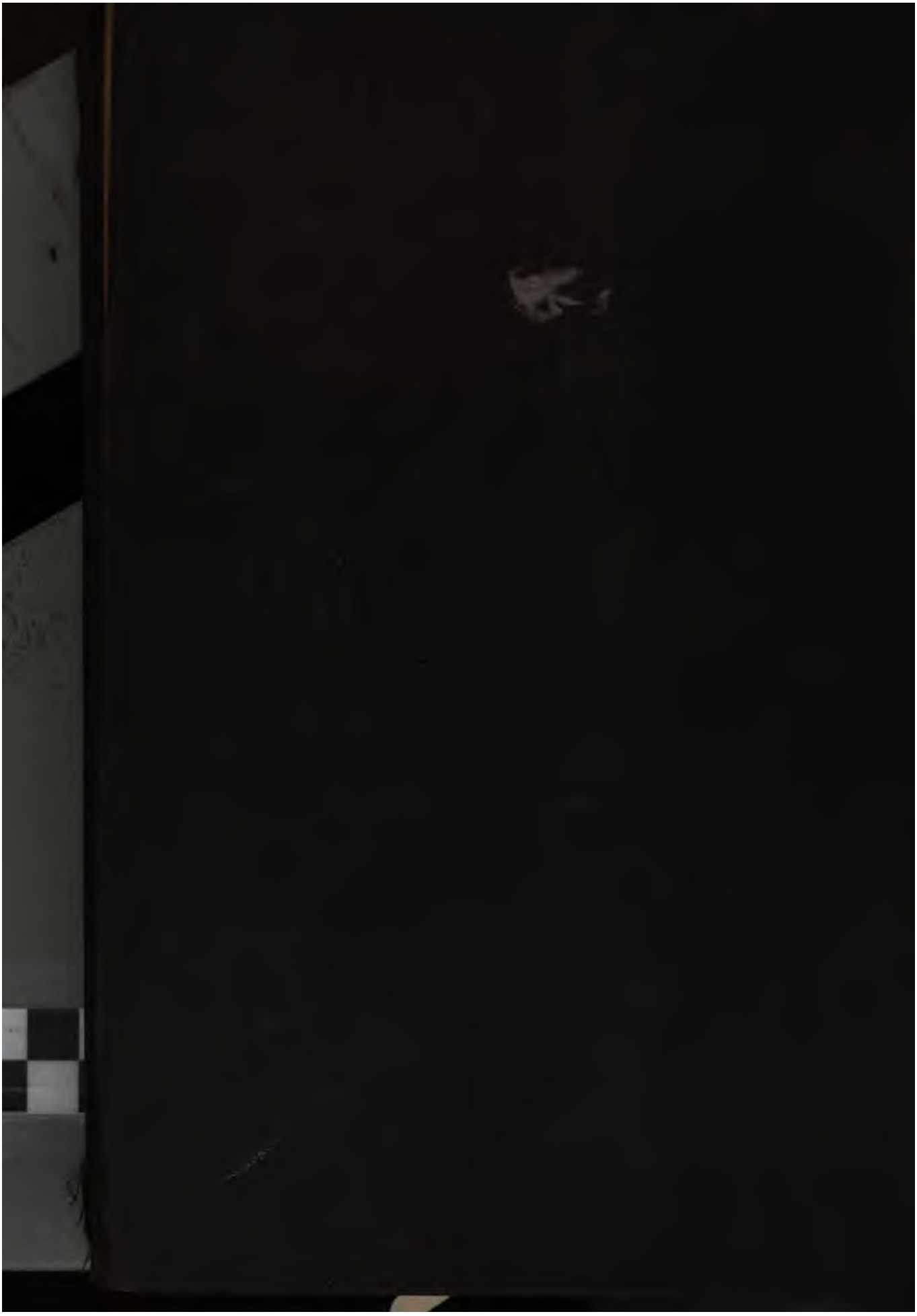
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